

*Paragraph 1926.451(h). Falling object protection.*

This paragraph addresses the protection of employees from scaffold-related falling object hazards. Paragraph (h)(1) of the final rule provides that employees working on scaffolds wear hardhats and be protected from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems or through the erection of debris nets, catch platforms, or canopy structures that deflect falling objects. In addition, when the falling objects to which employees on scaffolds may be exposed are too large, heavy or massive to be contained or deflected by any of the above-listed measures, the employer must protect affected employees by placing any such potential falling objects away from the edge of a surface from which they might fall and must secure those materials as necessary to prevent their falling.

This provision is similar to proposed paragraph (f)(1), which was based on existing §§ 1926.451(a)(16) and (h)(13). OSHA has added the phrase "hand tools, debris, and other small" to describe the type and size of objects that OSHA expects would be handled by toeboards, screens, guardrails, canopies, debris nets and catch platforms. In addition, the Agency has added language which requires that employers place materials away from an edge over which they might fall and secure those objects as necessary to prevent their falling, if those materials are so large, heavy or massive that the above-listed measures would not contain or deflect them. The changes that have been made to this requirement since the proposal are based on comments received from the SSFI and the SIA (Exs. 2-367 and 2-368) indicating that "compressors, marble, pipe, large bolts, etc. could be potentially falling objects" and that it is unreasonable to require guarding against such large objects.

OSHA agrees that the protective measures required by the proposed paragraph would not be adequate to withstand large objects. For example, a slab of marble facing would smash through screens or guardrails if it had not been properly stored and retained. In fact, an object of this mass would probably crash through a debris net or even a catch platform or protective canopy. As provided by the final rule, the appropriate way to protect affected employees from such large items is to locate those items away from the edge and to secure them to keep them from falling.

Because objects falling from scaffolds may injure employees working below, final rule paragraph (h)(2) requires employers to protect affected employees from that hazard and sets forth several alternative means by which employers can provide the required protection. The provisions of proposed paragraph (f)(2) were identical, except that debris nets and catch platforms have been added to the final rule, because, based on review of the rulemaking record, OSHA considers such measures to be acceptable alternatives.

Paragraph (h)(2)(i) provides for the use of barricades on lower levels to exclude employees from areas where falling objects might land. Compliance with this new provision will enable employers to eliminate employee exposure to the hazard.

Under paragraph (h)(2)(ii), employers would be required to provide toeboards along the edge of platforms more than ten feet above lower levels for a distance sufficient to protect workers below, except that on float (ship) scaffolds, an edging of  $\frac{3}{4}$  inch  $\times$   $1\frac{1}{2}$  inch wood, or a material with equivalent strength, may be used in lieu of a toeboard. This provision differs from existing § 1926.451(a)(4), which requires toeboards to be erected along the entire length of all open sides and ends of all scaffolds more than 10 feet high. The final rule, like proposed paragraph (f)(2)(ii), requires toeboards only where needed to protect employees below from falling object hazards.

For example, on a long scaffold where employees are working on the ground near one end of the scaffold, compliance with this provision would require the scaffold to have a toeboard at the end over the employees below, but not at the other end. This would be the case regardless of the height of the scaffold work platform. This change recognizes that toeboards and equivalent members are for the protection of employees below. Accordingly, if no employees are exposed, no protective measures are necessary.

Paragraph (h)(2)(iii) of the final rule provides, as an alternative, for erection of paneling or screening in cases where tools or other materials are piled to a height higher than the top edge of a toeboard. The panel or screen must extend from the toeboard (or platform) to the top of the guardrail and be erected for a distance sufficient to protect employees below. In addition, the panel or screen would need to be capable of withstanding, without failure, a force of at least 150 pounds, applied in any downward or outward direction at any point along the screen (to comply with paragraph (g)(4)(ix)). This provision is

effectively identical to proposed paragraph (f)(2)(iii). The proposed rule referenced the proposed § 1926.502 criteria for screens, while the final rule directly incorporates the applicable strength requirement from § 1926.502(b)(5), Fall protection (subpart M). OSHA believes that this revision will facilitate compliance by eliminating the need for employers to look up a cross reference.

Paragraph (h)(2)(iv) of the final rule allows employers to protect employees from falling objects through the installation of a guardrail system which complies with § 1926.451(g)(4) and which has openings small enough to reject passage of potential falling objects. This provision is identical to proposed paragraph (f)(2)(iv).

Paragraph (h)(2)(v) of the final rule provides that employers can protect employees working below scaffolds from falling objects through the installation of debris nets, catch platforms, or canopies that have sufficient strength to withstand the impact forces of potential falling objects.

In contrast to final rule paragraph (h)(2)(v), proposed paragraph (f)(2)(v) provided only for the use of a canopy structure. OSHA has added debris nets and catch platforms to this provision in response to the statement by Bristol Steel (Ex. 5a-3) that debris nets or catch platforms immediately below a scaffold could be more protective than a canopy many feet below. The Agency agrees that properly installed debris nets and catch platforms in place immediately below a scaffold will stop objects from falling closer to the source, and will lessen the possibility that these falling objects will pick up momentum and bounce off the canopy, injuring workers some distance from the area below the scaffold.

Hearing Notice Issue L-13 sought testimony and comments on a suggestion by the ACCSH (Tr. 6/9/87, 214-15) that proposed § 1926.451(f)(2)(v) specify nine feet as the proper height for the placement of a canopy. The ACCSH noted that the proposed requirement did not specify a height for canopy placement. According to the ACCSH, a canopy set at 15 or 20 feet would not protect employees below. However, the Advisory Committee did not provide a supporting rationale for its position.

Both the SIA (Exs. 10 and 5a-16, and Tr. 3/22/88, pp. 162-163) and SSFI (Ex. 5a-19) supported the placement of the canopy at a height of 10 feet. The SIA pointed out that standard scaffold frames are six-feet high and adding a three-foot frame would raise the canopy top, including the plank, to a height of

almost 10 feet. The SIA suggested that OSHA specify a "maximum" distance of 10 feet, noting that the proposed standard would not have allowed for any variation to accommodate these standard frames. The SSFI's comment stated that canopies "should be erected no greater than 10 feet above the work surface" and that because the intent of this requirement was to provide employee protection from small falling objects and/or light debris, "the term 'reasonable' should be included within the definition." In addition, the SSFI asked what anticipated impact forces such canopies would be required to withstand.

The National Chimney & Cooling Tower Association (Ex. 2-593) indicated that no height restriction was appropriate for canopies. The commenter stated that restricting the height would severely hamper equipment access. Bristol Steel (Ex. 5a-3) supported allowing maximum flexibility for designing various types of falling object protection for varying situations. This commenter stated that there should be no limitation on canopy height as long as the canopy functions as intended.

After carefully considering the comments and testimony received in response to this issue, OSHA believes that specifying a maximum height for canopy placement could unnecessarily restrict the use of equipment. In addition, the Agency believes that the use of performance-oriented language, requiring that canopies be strong enough to withstand the impact forces of potential falling objects, will ensure employee safety and at the same time provide the flexibility necessary to respond adequately to advances in technology as well as unusual or changing work-site conditions. The employer is responsible for determining the maximum size of potential falling objects and providing the appropriate protection.

Final rule paragraph (h)(3) sets criteria for the use of canopies. Paragraph (h)(3)(i) of the final rule, which is identical to proposed paragraph (f)(1)(i), requires that canopies be installed between the falling object hazard and the employees. Paragraph (h)(3)(ii) of the final rule, which is identical to proposed paragraph (f)(1)(ii), requires the use of additional independent support lines to support the scaffold in the event of suspension support rope failure, in cases where canopies are used for falling object protection on suspended scaffolds. The reason for this requirement, as stated in the discussion of final rule paragraph (g)(3), is that in

the event of a suspension rope failure, the additional lines would keep the scaffold from falling.

Paragraph (h)(3)(iii) of the final rule, which is identical to proposed paragraph (f)(1)(iii), requires that independent support lines and suspension ropes not be attached to the same point of anchorage. This new provision will prevent the loss of the backup safety systems in the event of suspension rope anchorage failure.

Final rule paragraph (h)(4) sets strength criteria for toeboards. Paragraph (h)(4)(i), which is a new requirement, requires that toeboards be capable of withstanding, without failure, a force of at least 50 pounds applied in any downward or horizontal direction at any point along the toeboard. This provision contains a note which indicates that toeboards built in accordance with Appendix A of subpart L will be deemed to comply with the standard. This provision, which is consistent with the corresponding requirement in OSHA's Fall Protection standard, § 1926.502(j)(2) (subpart M), is identical to proposed paragraph (f)(3)(i).

Final rule paragraph (h)(4)(ii) sets forth the construction requirements for toeboards. This provision requires that toeboards be at least three and one-half inches high, fastened securely in place, and have not more than 1/4-inch clearance above the walking/working surface. In addition, toeboards must be solid or have openings no greater than one inch in the greatest dimension. This provision, which is consistent with the corresponding requirement of the Fall Protection standard, § 1926.502(j)(3) (subpart M), is identical to proposed paragraph (f)(3)(ii), except as discussed below.

OSHA received one comment on proposed paragraph (f)(3)(ii). That commenter (Ex. 2-29) recommended a maximum space of 1/4-inch between the lower edge of the toeboard and the platform instead of the proposed 1/2-inch on the grounds that "many small tools and fastener materials can pass through a 1/2-inch opening." OSHA agrees that reducing this opening will enhance employee protection and has changed the language of the final rule accordingly.

#### *Other Issues Related to § 1926.451*

Issue L-7 of the hearing notice solicited testimony and related information on the extent to which proposed § 1926.451 ("General requirements") adequately covers smokestack hoist scaffolds. The Agency also requested testimony and information on stack hoist hazards not addressed by the general requirements,

and explained that the issue was being raised in light of ongoing efforts to update ANSI standard A10.22, Safety Requirements for Rope Guided and Non-Guided Workmen's Hoists. OSHA noted that the final rule might need to include provisions to address the hazards unique to stack hoist scaffolds. However, because stack hoist scaffolds are included in the definitions of "scaffold" and "suspension scaffold" used in the scaffold rules, OSHA concludes that the final rule does not need to include specific coverage for stack hoist scaffolds. OSHA notes that, since the proposal, the ANSI A10.22-1977 standard for stack hoist scaffolds has been rescinded and has not been replaced.

#### *§ 1926.452 Additional Requirements Applicable to Specific Types of Scaffolds*

Section 1926.452 of the final rule contains requirements that supplement the requirements of § 1926.451 with regard to particular types of scaffolds. The identified scaffolds have unique features which require specific attention. This approach is consistent with that taken in existing §§ 1926.451 (b) through (y), which set out additional provisions for specific types of scaffolds.

OSHA received comments (Exs. 2-13 and 2-23) which suggested that specific scaffold design criteria and fall protection requirements be added to proposed § 1926.452 (particularly to proposed paragraphs (i), (l), (m), (q), (r), (s), (t), (u) and (v)). OSHA has determined that compliance with the performance-oriented provisions of final rule §§ 1926.451 and 1926.452, taken together, will provide adequate protection for employees working on scaffolds. Further, the Agency believes that the specification language suggested by the commenters would limit innovation and impose unreasonable burdens on employers.

As discussed in the preamble to the proposed rule (51 FR 42691-6), many existing § 1926.451 requirements are not being carried forward in final rule § 1926.452 because the topics they address (capacity, construction, access, fall protection and falling object protection) are covered by provisions in final rule § 1926.451. The provisions being reordered are presented in Table 1, which shows the requirement in OSHA's existing rule and the corresponding provision in the final rule being published today.

TABLE 1.—PROVISIONS BEING REORDERED IN THE FINAL RULE

Existing paragraph	Final rule paragraph
§ 1926.451(b)(1) .....	§ 1926.451(c)(3), (d)(1)
§ 1926.451(b)(3) .....	§ 1926.451(b)(3)
§ 1926.451(b)(4) .....	§ 1926.451(c)(2)
§ 1926.451(b)(6) .....	§ 1926.451(a)(1)
§ 1926.451(b)(8) .....	§ 1926.451(d)(1)
§ 1926.451(b)(11) .....	§ 1926.451(b)(1)
§ 1926.451(b)(12) .....	§ 1926.451(b)(4), (6) and § 1926.451(a)(1)
§ 1926.451(b)(13) .....	§ 1926.451(b)(7)
§ 1926.451(b)(15) .....	§ 1926.451(g)
Tables L–4 through L–9 .....	§ 1926.451(a)(1) and (g)
§ 1926.451(c)(1) .....	§ 1926.451(a)(1) and (c)(1)
§ 1926.451(c)(2) .....	§ 1926.451(a)(1) and (c)(1)
§ 1926.451(c)(3) .....	§ 1926.451(a)(1) and (c)(1)
§ 1926.451(c)(5) .....	§ 1926.451(a)(1)
§ 1926.451(c)(6) .....	§ 1926.451(d)(1)
§ 1926.451(c)(7) [last sentence] .....	§ 1926.451(a)(1)
§ 1926.451(c)(12) .....	§ 1926.451(c)(2)
§ 1926.451(c)(13) .....	§ 1926.451(g)
Tables L–10 through L–12 .....	§ 1926.451(a)(1)
§ 1926.451(d)(1) .....	§ 1926.451(a)(1)
§ 1926.451(d)(4) .....	§ 1926.451(b)(15)
§ 1926.451(d)(7) .....	§ 1926.451(b)(14)
§ 1926.451(d)(8) .....	§ 1926.451(a)(1) and Appendix A
§ 1926.451(d)(10) .....	§ 1926.451(g)
§ 1926.451(q)(2) .....	§ 1926.451(b)(1)
§ 1926.451(q)(3) .....	§ 1926.451(e)
§ 1926.451(q)(4) .....	§ 1926.451(g)
§ 1926.451(n)(1) .....	§ 1926.451(a)(1)
§ 1926.451(n)(2) .....	§ 1926.451(a)(1)
§ 1926.451(n)(5) .....	§ 1926.451(a)(1)
§ 1926.451(n)(7) .....	§ 1926.451(c)(3)
Table 15 .....	§ 1926.451(a)(1)
§ 1926.451(o)(2) .....	§ 1926.451(a)(1)
§ 1926.451(o)(3) .....	§ 1926.451(a)(1)
§ 1926.451(o)(6) .....	§ 1926.451(f)(5)
§ 1926.451(o)(7) .....	§ 1926.451(g)
Table 16 .....	§ 1926.451(a)(1)
§ 1926.451(m)(1) .....	§ 1926.451(a)(1)
§ 1926.451(m)(3) .....	§ 1926.451(a)(1)
§ 1926.451(m)(4) .....	§ 1926.451(a)(1)
§ 1926.451(m)(5) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
§ 1926.451(m)(6) .....	§ 1926.451(g)
§ 1926.451(x)(1) .....	§ 1926.451(a)(1)
§ 1926.451(x)(2) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
§ 1926.451(x)(3) .....	§ 1926.451(f)(2)
§ 1926.451(x)(4) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(1)
	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
§ 1926.451(x)(5) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
	§ 1926.451(g)
§ 1926.451(x)(6) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
	§ 1926.451(g)
Tables L–17, 18 and 19 .....	§ 1926.451(a)(1)
	§ 1926.451(g)
§ 1926.451(g)(1) (in part) .....	§ 1926.451(a)(1)
§ 1926.451(g)(4) .....	§ 1926.451(b)(3)
	§ 1926.452(i)(8)
§ 1926.451(g)(5) .....	§ 1926.451(g)
Table L–13 .....	§ 1926.451(a)(1)
§ 1926.451(y)(1) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(y)(3) .....	§ 1926.451(b)(1)
§ 1926.451(y)(4) (i) and (ii) (also (iii) in part) .....	§ 1926.451(a)(1)

TABLE 1.—PROVISIONS BEING REORDERED IN THE FINAL RULE—Continued

Existing paragraph	Final rule paragraph
§ 1926.451(y)(5) (also (y)(6) and (y)(7) in part) .....	§ 1926.451(c)(3)
§ 1926.451(y)(9) .....	§ 1926.451(e)
§ 1926.451(y)(10) .....	§ 1926.451(a)
§ 1926.451(y)(11) .....	§ 1926.451(g)
§ 1926.451(s)(5) .....	§ 1926.451(a)(1)
	§ 1926.451(b)(5)
§ 1926.451(s)(6) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(t)(3) .....	§ 1926.451(g)
§ 1926.451(t)(4) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(k)(1) .....	§ 1926.451(d)(13)
§ 1926.451(k)(2) .....	§ 1926.451(d)(14)
§ 1926.451(k)(3) .....	§ 1926.451(d)(15)
§ 1926.451(k)(4) .....	§ 1926.451(d)(16)
§ 1926.451(k)(5) .....	§ 1926.451(f)(3)
§ 1926.451(k)(8) .....	§ 1926.451(d)(2) through (d)(16)
§ 1926.451(k)(9) .....	§ 1926.451(g)
§ 1926.451(k)(10) .....	§ 1926.451
§ 1926.451(l)(4) .....	§ 1926.451(g)
§ 1926.451(l)(6) .....	§ 1926.451(d)(5)
§ 1926.451(h)(1) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(h)(2) .....	§ 1926.451(d)(13)
§ 1926.451(h)(3) .....	§ 1926.451(a)(2)
§ 1926.451(h)(4) .....	§ 1926.451(d)(4)
§ 1926.451(h)(5) .....	§ 1926.451(a)(1)
§ 1926.451(h)(6) .....	§ 1926.451(a)(1)
	§ 1926.451(d)(3)(i)
§ 1926.451(h)(7) .....	§ 1926.451(d)(4)(iii)
§ 1926.451(h)(8) .....	§ 1926.451(d)(4)(i)
§ 1926.451(h)(9) .....	§ 1926.451(d)(2)
§ 1926.451(h)(10) .....	§ 1926.451(d)(9)
	§ 1926.451(d)(7)
§ 1926.451(h)(11) .....	§ 1926.451(d)(4)(iv)
§ 1926.451(h)(12) .....	§ 1926.451(a)(1)
§ 1926.451(i)(2) .....	§ 1926.451(g)
§ 1926.451(i)(9) .....	§ 1926.451(d)(18)
§ 1926.451(j)(1) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(j)(2) .....	§ 1926.451(d)(13)
§ 1926.451(j)(3) .....	§ 1926.451(b)(4)
	§ 1926.451(b)(5)
§ 1926.451(j)(4) .....	§ 1926.451(d)(4)
	§ 1926.451(d)(5)
§ 1926.451(j)(5) .....	§ 1926.451(d)(4)(iii)
	§ 1926.451(d)(3)
	§ 1926.451(d)(4)(i)
§ 1926.451(j)(6) .....	§ 1926.451(a)(1)
	§ 1926.451(a)(2)
§ 1926.451(j)(7) .....	§ 1926.451(d)(9)
	§ 1926.451(d)(7)
§ 1926.451(j)(8) .....	§ 1926.452(q)(1)
	§ 1926.452(q)(2)
§ 1926.451(j)(9) .....	§ 1926.451(g)
§ 1926.451(w)(1) .....	§ 1926.451(a)(1)
	§ 1926.451(f)(2)
§ 1926.451(w)(2) .....	§ 1926.451(a)(1)
§ 1926.451(w)(4) .....	§ 1926.451(g)
§ 1926.451(w)(5) .....	§ 1926.451(a)(2)
	§ 1926.451(f)(4)
§ 1926.451(w)(6) .....	§ 1926.451(g)
§ 1926.451(r)(2) .....	§ 1926.451(a)(2)
	§ 1926.452(t)(3)
§ 1926.451(r)(3) .....	§ 1926.451(a)(1)
§ 1926.451(r)(4) .....	§ 1926.451(a)(1)
§ 1926.451(r)(5) .....	§ 1926.451(g)
§ 1926.451(e)(1) .....	§ 1926.451(c)(2)
§ 1926.451(e)(2) .....	§ 1926.451(a)(1)
	§ 1926.452(w)(2)
§ 1926.451(e)(4) .....	§ 1926.451(b)(1)

TABLE 1.—PROVISIONS BEING REORDERED IN THE FINAL RULE—Continued

Existing paragraph	Final rule paragraph
§ 1926.451(e)(5) .....	§ 1926.451(e)(1) § 1926.451(e)(2) § 1926.451(e)(3)
§ 1926.451(e)(8) .....	§ 1926.451(c)(3) § 1926.451(d)(1) § 1926.452(w)(2)
§ 1926.451(e)(10) .....	§ 1926.451(g)

**Paragraph (a) Pole Scaffolds**

Final rule paragraph (a) sets requirements for the proper use of bearers, braces and runners on pole scaffolds. The corresponding provision in existing § 1926.451(b) is titled "Wood pole scaffolds." The final rule has deleted the word "wood" from the title of the paragraph, since pole scaffolds can be constructed of other materials. In addition, the final rule provides that pole scaffolds over 60 feet in height be designed by a registered professional engineer, and must be constructed and loaded in accordance with that design. The provision also notes that non-mandatory Appendix A contains examples of criteria that will enable an employer to comply with design and loading requirements for pole scaffolds under 60 feet in height. These provisions are virtually identical to those in the proposal, except for minor editorial revisions for the sake of clarity, as discussed below. In addition, as illustrated by Table 2, many existing § 1926.451(b) requirements are being carried forward in paragraph (a) of § 1926.452 of the final rule.

TABLE 2.—PROVISIONS BEING  
RENUMBERED IN THE FINAL RULE

Existing paragraph	Final rule paragraph
§ 1926.451(b)(14) .....	§ 1926.452(a)(1)
§ 1926.451(b)(9) .....	§ 1926.452(a)(2)
§ 1926.451(b)(10) .....	§ 1926.452(a)(3)
§ 1926.451(b)(10) .....	§ 1926.452(a)(4)
§ 1926.451(b)(5) .....	§ 1926.452(a)(5)
§ 1926.451(b)(5) .....	§ 1926.452(a)(6)
§ 1926.451(b)(6) .....	§ 1926.451(a)
§ 1926.451(b)(7) .....	§ 1926.452(a)(7)
§ 1926.451(b)(7), (10) ....	§ 1926.452(a)(8)
§ 1926.451(b)(2) .....	§ 1926.452(a)(9)
§ 1926.451(b)(16) .....	§ 1926.452(a)(10)

OSHA received three comments (Exs. 2-13, 2-367 and 2-368) on proposed § 1926.452(a). The SSFI (Ex. 2-367) recommended that OSHA change the term "Ledger" to "Runners" because "Runners" is the correct terminology. OSHA agrees and has incorporated that change into paragraph (a) of the final rule.

The other commenters (Exs. 2-13 and 2-368) objected to the proposed deletion of the word "wood" from the title of this paragraph, stating that this section refers only to wood pole scaffolds. OSHA believes that all pole scaffolds, whatever their composition, need to be covered by the criteria of proposed paragraph (a) and, accordingly, has not made the suggested change.

Finally, the Agency has editorially revised the text of final rule § 1926.452(a)(10) to clarify that non-mandatory Appendix A contains examples of criteria that will enable an employer to comply with design and loading requirements for pole scaffolds under 60 feet in height, and that pole scaffolds over 60 feet in height must be designed by a registered professional engineer. This revision highlights the fact that the proposed criteria and now the final rule criteria in non-mandatory Appendix A are limited to heights of less than 60 feet.

**Paragraph (b) Tube and Coupler Scaffolds**

Paragraph (b) sets requirements for the use of bearers, bracing, runners and couplers on tube and coupler scaffolds. In addition, the final rule provides that tube and coupler scaffolds over 125 feet in height be designed by a registered professional engineer, and be constructed and loaded in accordance with such design. The provision also notes that non-mandatory Appendix A contains examples of criteria that will enable an employer to comply with design and loading requirements for tube and coupler scaffolds under 125 feet in height. These provisions are virtually identical to the proposed provisions, except as discussed below.

Final rule paragraph (b)(1), which is identical to the corresponding provision of the proposed rule, is a new requirement for tube and coupler scaffolds. This provision requires that platforms not be moved until the next location has been properly prepared to support the platform being moved. This is the same requirement as existing § 1926.451(b)(14) (final rule

§ 1926.452(a)(1)) for wood pole (pole) scaffolds. This rule was added to this section because it addressed the problem of platform stability during construction, a problem which exists for tube and coupler scaffolds as well as pole scaffolds.

Paragraph (b)(2) of the final rule requires the installation of transverse bracing at the scaffold ends and, at least, at every third set of posts horizontally and every fourth post vertically. This paragraph provides for diagonal bracing from the outer or inner posts or runners upward to the next outer or inner posts or runners. In addition, building ties must be installed at the bearer levels between the diagonal braces in conformance with § 1926.451(c)(1). This provision is consistent with existing § 1926.451(c)(10).

This requirement differs from the proposed paragraph (b)(2), which required transverse bracing to be installed for each section of six levels between the fourth and sixth level.

The SSFI and the SIA (Exs. 2-367 and 2-368) recommended that transverse bracing be installed at the base and be repeated every third and fourth level vertically, and that building ties be installed "at bearer levels adjacent to the bracing" (Ex. 2-367), or at "the bearer levels between the diagonal brace[s]" (Ex. 2-368). In support of the suggested change, the SIA (Ex. 2-368) stated "[t]his revision would correct the inaccuracy which has existed for years in the current standard and will conform to proper engineering criteria." Another commenter (Ex. 2-15) pointed out that the proposal did not require transverse bracing at the base of the scaffold. In addition, a commenter (Ex. 2-42) recommended that transverse bracing be installed at the scaffold ends and at least at every third set of posts, that such bracing be installed on every level and that it extend diagonally from the inner or outer posts or runners.

OSHA has determined that the proposed bracing specifications would not provide adequate structural stability for tube and coupler scaffolds. In

particular, OSHA has concluded that bracing at the third and fourth levels, as suggested by the SSFI and the SIA and as provided in ANSI A10.8-1988, paragraph 8.11, will provide appropriate stability. On the other hand, the Agency believes that bracing at every level would be unnecessarily burdensome, perhaps even affecting the capacity of the scaffold. Therefore, OSHA is returning to the approach taken by existing § 1926.451(c)(10). The Agency has concluded that compliance with the suggested provisions will increase scaffold stability appropriately and has revised the final rule to reflect this finding. In addition, OSHA has drafted the final provision to indicate clearly that the placement of building ties must comply with final rule § 1926.451(c)(1) (proposed as § 1926.451(b)(13)).

Paragraph (b)(3) of the final rule, which is basically the same as the proposed paragraph, is based on existing § 1926.451(c)(11). This provision sets requirements for the installation of longitudinal bracing across the inner and outer rows of posts for straight run scaffolds. In particular, such bracing must be installed diagonally in both directions and shall extend from the base of the end posts upward to the top of the scaffold at a 45 degree angle. Where scaffold length is greater than height, bracing shall be repeated at least at every fifth post. Where scaffold length is less than height, such bracing shall be installed from the base of the end posts upward to the opposite end posts and then in alternating directions until reaching the top of the scaffold. In addition, bracing shall be installed as close as possible to the intersection of the bearer and post or of the runner and post. The proposed provision was identical, except that it did not specify that only straight run scaffolds were covered or that the bracing had to be installed as close as possible to a post's intersection with bearers or runners.

The SSFI and the SIA (Exs. 2-367 and 2-368) suggested that OSHA limit application of the proposed provision to straight run scaffolds and that the Agency specify the proximity of bracing to the intersection of posts with bearers or runners. The Agency believes that limiting the provision to straight run scaffolds is appropriate, since when a tube and coupler scaffold is installed around circular structures or at corners, the inside leg is braced in the direction perpendicular to the walkway (platform) because the runners come in at less than 180 degrees. In addition, OSHA agrees that it is appropriate to include requirements regarding where to position bracing, and the final provision

has been written accordingly. (Bracing requirements for those tube and coupler scaffolds that are not straight run scaffolds are found in final rule § 1926.451(c).)

Paragraph (b)(4) of the final rule requires that bracing be attached to the runners as close to the post as possible, where conditions preclude attachment of bracing to posts. This provision is basically the same as the proposed provision, which was based on existing § 1926.451(c)(11). OSHA has modified this provision based on comments from the SSFI and the SIA (Exs. 2-367 and 2-368) which suggested that "as close to the post as possible" be added to the end of this paragraph. The Agency recognizes that attachment to the post, while the most desirable option, is not always possible. In circumstances where such attachment is not possible, OSHA has determined that attachment to the runner, as close as possible to the post, will still maximize directional stability and provide the strength necessary to properly brace the scaffold.

Paragraphs (b)(5) through (b)(10) of the final rule are identical to corresponding provisions of the proposed rule, except for some minor editorial revision to paragraph (b)(10). As explained in the preamble to the proposed rule (51 FR 42691), these provisions are based on existing §§ 1926.451 (b) and (c).

#### Paragraph (c) Fabricated Frame Scaffolds

Paragraph (c) of the final rule provides additional requirements for fabricated frame scaffolds (tubular welded frame scaffolds). Two commenters (Exs. 2-13 and 2-320) recommended that OSHA retain the title, "Tubular Welded Frame Scaffolds" used in the existing rule. As discussed above in reference to the definitions in § 1926.450(b), however, OSHA has not followed this suggestion but has retained the existing title in parentheses after the new title. Paragraph (c) of the final rule is virtually identical to the corresponding provision in the proposal except as discussed below.

Paragraph (c)(1) of the final rule is a new requirement for fabricated frame scaffolds. It requires that platforms not be moved until the next location is properly prepared and ready to support the platform being moved. This provision is necessary to ensure that the scaffold is positioned on a level and stable surface, as discussed for final rule § 1926.451(b)(1), above.

Final rule paragraphs (c)(2), (c)(3) and (c)(6), which are identical to the corresponding proposed paragraphs, are effectively identical to existing

§ 1926.451(d) (3), (5) and (9), respectively.

Final rule paragraph (c)(4), which is identical to the parallel provision of the proposed rule, requires the locking together of end frames, and is essentially the same as existing § 1926.451(d)(6). This requirement only applies where uplift forces are strong enough to displace the end frames or panels, such as when a hoist is being used that could snag the scaffold during a hoist operation.

Final rule paragraph (c)(5) specifies the proper placement of platform support brackets. Improper placement of such cantilever supports can significantly reduce their support capacity and thus endanger employees working on top of the platform. Proposed paragraph (c)(5) set seating requirements for brackets and required that brackets not be bent or twisted from those positions. This provision of the final rule is identical except that it also allows the use of bracket systems to support loads other than employees only where the system has been designed and built to withstand the tipping forces imposed by those other loads.

OSHA received comments from the SSFI and the SIA (Exs. 2-367 and 2-368) suggesting that such brackets be allowed for the support of personnel but not for the storage or support of materials. Based on those comments, Issue L-8 of the hearing notice solicited testimony and supporting information regarding the revision of proposed § 1926.452(c)(5) to require that side brackets on fabricated frame scaffolds " \* \* \* be used to support personnel only and shall not be used for storage or support of materials." OSHA also indicated that, in the Agency's opinion, this area would be adequately covered by proposed § 1926.451(a)(1), which sets capacity requirements, and proposed § 1926.451(d)(1), which prohibits overloading.

The SIA (Exs. 5a-16 and 10) stated that, since users may not know the load capacities of their side brackets without consulting a loading table, they may unintentionally overload the units. The SIA explained that "employees tend not to respect the dangers involved" with side bracket loads, which "induce an eccentric load and overturning propensity on the scaffold system." They further noted that the "aisle" provided by a series of side brackets is typically 20 inches wide, which provides insufficient room for employees to step around stored material. The SIA testimony (Tr. 3/22/88, p. 160) repeated these concerns but added that bracket systems properly

designed to take loads other than workers should not be prohibited by the final rule.

Bristol Steel (Exs. 5a-3 and 13) stated that proposed § 1926.451(a)(1) and (d)(1) would adequately address the SIA and SSFI concerns, and therefore did not support the suggested additional language.

After carefully considering the above-described comments, OSHA has determined that fabricated frame scaffolds which utilize bracket systems must be used only to support personnel, unless the scaffold has been designed for other loads by a qualified engineer and been built to withstand the tipping forces caused by the loads being placed on the bracket supported section of the scaffold. The final rule reflects this determination (paragraph (c)(5)(iii)). OSHA believes that compliance with this requirement will provide employees working on fabricated frame scaffolds with the protection they need while working on this type of scaffold.

#### Paragraph (d) Plasterers', Decorators' and Large Area Scaffolds

(d) of the final rule requires that plasterers', decorators' and large area scaffolds be constructed in accordance with § 1926.452(a), (b), or (c) of this section. This requirement is identical to that in the proposed rule. Paragraph (d) references the provisions of paragraphs (a), (b), and (c) because plasterers', decorators' and large area scaffolds are almost always constructed using pole scaffolds, tube and coupler scaffolds, or fabricated frame scaffolds. The existing rule, § 1926.451(q)(1), required that the scaffolds in question be built only according to the existing rules for pole scaffolds. OSHA believes that compliance with the provisions of §§ 1926.452(a), (b) or (c) will provide appropriate protection for employees covered by paragraph (d).

#### Paragraph (e) Bricklayers' Square Scaffolds (Squares)

Paragraph (e) provides additional requirements for bricklayers' square scaffolds (squares). This paragraph requires that scaffolds made of wood be reinforced with gussets on both sides of each corner (paragraph (e)(1)); that diagonal braces be installed on all sides of each square (paragraph (e)(2)); that diagonal braces be installed between squares on the rear and front sides of the scaffold, and extend from the bottom of each square to the top of the next square (paragraph (e)(3)); and that scaffolds of this type not exceed three tiers in height, that they be constructed and arranged so that one square rests directly above the other, and that the

upper tiers stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement (paragraph (e)(4)). These requirements are identical to those in the proposed rule.

Final rule paragraphs (e)(1), (2), and (3) contain essentially the same requirements as existing §§ 1926.451(n)(3) and (4), except that the specific requirements for the size of the member are being replaced by the capacity requirements of § 1926.451(a)(1). OSHA notes that non-mandatory Appendix A of this final rule provides examples of component dimensions for bricklayers' square scaffolds that would be deemed to comply with § 1926.451(a)(1). Final rule paragraph (e)(4) contains the same requirement as existing § 1926.451(n)(6).

#### Paragraph (f) Horse Scaffolds

Paragraph (f) provides additional requirements for horse scaffolds. This paragraph requires that horse scaffolds not be constructed or arranged more than two tiers or 10 feet (3.0 m) in height, whichever is less (paragraph (f)(1)); when arranged in tiers, that each horse be placed directly over the horse in the tier below (paragraph (f)(2)); when arranged in tiers, the legs of each horse shall be nailed down or otherwise secured to prevent displacement (paragraph (f)(3)); and that, when arranged in tiers, each tier shall be crossbraced (paragraph (f)(4)). These requirements, which are identical to the parallel provisions of the proposed rule, correspond to existing § 1926.451(o)(1), (o)(4) and (o)(5), respectively.

#### Paragraph (g) Form Scaffolds and Carpenters' Bracket Scaffolds

Paragraph (g) of the final rule, which is effectively unchanged since the proposal, provides additional rules for form scaffolds and carpenters' bracket scaffolds. Under the existing standard, carpenters' bracket scaffolds and form scaffolds are addressed separately (existing §§ 1926.451(m) and (x), respectively). However, OSHA has determined that the two types are so similar that it is appropriate to address them in a single paragraph.

Final rule paragraph (g)(1) carries forward the requirements for attachment of a scaffold to a supporting framework or structure set by existing § 1926.451(m)(2), (x)(4)(ii), and (x)(5).

Paragraph (g)(2), in turn, maintains the existing § 1926.451(x)(6)(i) requirement that wooden bracket form scaffolds be an integral part of the form panel. Paragraph (g)(3), like existing § 1926.451(x)(5)(i), requires that folding

type metal brackets, when extended for use, shall be either bolted or secured with a locking-type pin.

#### Paragraph (h) Roof Bracket Scaffolds

Paragraph (h) of the final rule provides additional requirements for roof bracket scaffolds. This paragraph requires that scaffold brackets be constructed to fit the pitch of the roof and provide a level support for the platform (paragraph (h)(1)); and that brackets be anchored in place by nails unless it is impractical to use nails (paragraph (h)(2)). Paragraph (h)(2) further provides that brackets shall be held in place with first-grade manila rope of at least three-fourth inch diameter, or a rope with equivalent strength, when nails are not used. These provisions are essentially identical to the corresponding proposed provisions and to existing §§ 1926.451(u)(1) and (u)(2), respectively.

Existing § 1926.451(u)(3) requires the installation of catch platforms below the working area of roofs more than 16 feet from the ground and having a slope greater than 4 inches in 12 inches without a parapet. This provision also requires that the platform extend at least 2 feet from the eaves and that employees be protected from falls by a guardrail system unless employees are using personal fall arrest systems. The existing provision is being replaced by the general fall protection requirements of § 1926.451(g). The final rule, like the proposal, allows guardrails on roof bracket scaffolds to be mounted on a catch platform or be attached to the eaves. Therefore, the Agency has concluded that there is no need to mention catch platforms in this provision. OSHA has determined that it is appropriate to allow employers flexibility in choosing where to attach guardrails. The Agency notes that a catch platform is an elevated work platform that meets the definition of a scaffold and therefore must comply with the pertinent provisions of this final rule.

#### Paragraph (i) Outrigger Scaffolds

Paragraph § 1926.452(i) of the final rule provides additional requirements for outrigger scaffolds. Except for editorial changes, as noted below, the requirements of the final rule are identical to those of the proposed rule. Paragraphs (i)(1) through (i)(4), which set requirements for the proper positioning and securing of outrigger beams, are consistent with existing § 1926.451(g)(1). Some editorial changes have been made to proposed paragraph (i)(2), as suggested by a commenter (Ex. 2-64), in order to clarify OSHA's

regulatory intent that the supporting beam be used in its strongest orientation. Paragraphs (i)(5) and (i)(6), which require that the inboard ends of outrigger beams be securely anchored and that the entire supporting structure be securely braced, respectively, are effectively identical to existing § 1926.451(g)(2). Proposed paragraph (i)(5) has undergone minor editorial changes since the proposal: the existing provisions have been broken down into their component parts to facilitate compliance.

Final rule paragraph (i)(7), which is identical to the corresponding requirement in the proposed rule, requires that platform units be nailed, bolted or otherwise secured to outriggers, to prevent displacement. The corresponding language in existing § 1926.451(g)(4) required simply that planking be secured to the beams. OSHA believes that the revised language better expresses the Agency's intention that employers use effective means when securing platform units to outrigger beams.

Paragraph (i)(8) requires that scaffolds and scaffold components be designed by a registered professional engineer and constructed and loaded in accordance with such design. This provision has been revised to reflect OSHA's determination that the design of this type of scaffold involves calculations that required the skills of a registered professional engineer, and that the criteria in the proposed rule had such limited applicability as to be of virtually no help to employers in almost all situations. The proposed rule was based on existing § 1926.451(g)(3).

#### Paragraph (j) Pump Jack Scaffolds

Paragraph 1926.452(j) of the final rule provides additional rules for pump jack scaffolds. Paragraph (j)(1) requires that pump jack brackets, braces, and accessories be fabricated from metal plates and angles. In addition, each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage. This provision is identical to the proposed paragraph and to existing § 1926.451(y)(2).

Paragraph (j)(2) requires that poles be secured to the structure by rigid triangular bracing or equivalent, at the bottom, top, and other points as necessary. In addition, that provision further requires that when the pump jack has to pass bracing that is already installed, an additional brace must be installed approximately four feet (1.2 m) above the brace to be passed. That additional brace must be left in place until the pump jack has been moved

and the original brace reinstalled. These requirements, which are identical to the proposed paragraph except for an editorial revision, are essentially the same as existing §§ 1926.451(y)(4) (iii) and (iv).

NPRM Issues 9 and 22 asked for comments about whether OSHA should remove the requirement for bottom braces on pump jack scaffolds. One commenter (Ex. 2-13) stated that from his experience, \* \* \* "no one uses any but the top pole brace." Another commenter (Ex. 2-31) agreed with this assessment, saying, in part, "[i]n terms of common practice, the bottom brace is virtually nonexistent. In terms of practicality, homeowners do not permit holes made in their foundation." This same commenter continued that "[i]n terms of functions, the bottom brace does not relieve the pole from breaking," and added as follows:

There exists the misconception that a pumpjack pole will shoot out when a load is applied to it. Fact is, the greater the load, the greater the anchorage. Our in plant testing is done with no brace securement. This, along with my 10 years plus of field inspections, substantiates the unreality of a bottom brace. More accidents would be experienced from tripping over bottom braces; and eye accidents from securement to concrete. Overwhelmingly, the bottom brace simply does not belong. When a wooden pumpjack pole is used, § 1926.451(a)(1) can better be achieved with mid-bracing. The location of a pumpjack on a pole is not a true fulcrum point. That is an erroneous assumption that precedes the pole pulling away from the wall at the bottom assumption.

NIOSH recommended (Ex. 2-40) bracing or securing the bottom of pump scaffold columns "in some manner at all times." NIOSH stated that if "the employer chooses to brace in a different manner than suggested by the [existing] regulations, then the method used must be shown to be equivalent to that required by the regulations."

Another commenter (Ex. 2-54) stated the "bottom brace should remain for poles, [because that part of the scaffold] is the one part that is easiest to hit and move." The commenter added that the "bottom brace seems like the one that is needed the most \* \* \*" After reviewing this issue, the ACCSH also recommended that the requirement for a bottom brace be retained (Tr. 6/9/87, pp. 95-96).

Based on its review of the comments, OSHA has determined that employers do need to brace the bottom of the support pole to keep it in place, but that it is not necessary to specify the use of a rigid triangular bottom brace. Other methods, such as anchoring the pole to the ground, would provide equivalent support. Therefore, the final rule

requires, as did the proposal, that pumpjack poles be braced at the bottom by triangular bracing or equivalent means.

A commenter (Ex. 2-52) stated that "[a] requirement for braces every ten vertical feet has been eliminated. Insofar as the same applies to wooden poles, we believe this requirement should be maintained in the Regulations." OSHA is aware that existing § 1926.451(y)(4)(i) provides for 10 foot spacing of poles (center to center) when wood scaffold planks are used as platforms for pump jack scaffolds. That paragraph further provides that pole spacing may exceed 10 feet center to center when fabricated platforms are used that fully comply with all other provisions of existing paragraph (y). The Agency proposed to delete existing paragraph (y)(4)(i) because OSHA believed that compliance with the capacity requirements of proposed § 1926.451 (a)(1) would provide adequate assurance that a pump jack scaffold was structurally sound and able to hold the anticipated loads. As indicated above, the Agency believes that it is appropriate to focus on the capacity of the scaffold, not on the exact spacing of the braces, when evaluating the adequacy of a particular pump jack scaffold. Accordingly, OSHA has not made the suggested change.

That commenter also stated "The explanation for additional bracing is confusing. We believe the phrase 'on the side opposite the brace from the pump jack' should read: 'above the brace to be passed'." OSHA agrees that the suggested language, which appears in existing § 1926.451(y)(4)(iv), more clearly expresses the Agency's intent, and this is reflected in the final rule at paragraph (j)(2).

Paragraph (j)(3) provides, when guardrails are used for fall protection, that a workbench may be used as the toprail only if the workbench complies with the requirements of §§ 1926.451(g)(4) (ii), (vii), (viii) and (xiii). This provision is effectively identical both to the proposed provision and to existing § 1926.451(y)(12).

Paragraph (j)(4) provides that work benches shall not be used as scaffold platforms. This provision, which is identical to the corresponding provision of the proposed rule, is effectively identical to existing § 1926.451(y)(13).

Paragraph (j)(5) provides, when poles are made of wood, that the pole lumber shall be straight-grained, free of shakes, large loose or dead knots, and other defects which might impair strength. This provision, which is unchanged from that in the proposed rule, is based on existing § 1926.451(y)(6). OSHA has deleted existing specification language



which addressed the dimensions and type of wood to be used, because OSHA believes that wood poles which comply with the performance requirements of final rule § 1926.451(a)(1) will provide adequate protection for affected employees.

Paragraph (j)(6) provides, when wood poles are constructed of two continuous lengths, that the lengths shall be joined together with the seam parallel to the bracket. This provision, which is unchanged from the corresponding provision of the proposed rule, is based on existing § 1926.451(y)(7). The Agency has deleted the existing specification language, which addressed the dimensions of the wood to be used and the means of joining, because OSHA believes, again, that compliance with § 1926.451(a)(1) will provide adequate protection for affected employees. The Agency notes that the language in question has been included in non-mandatory Appendix A to provide an example of how an employer could comply with § 1926.451(a).

Final rule paragraph (j)(7) requires, when two by fours are spliced to make a pole, that mending plates be installed at all splices to develop the full strength of the member. This provision differs from the proposed requirement because it requires mending plates at splices. Proposed paragraph (j)(7) required that splices be constructed to develop the full strength of the member, but did not require mending plates.

NPRM Issue 9 asked whether proposed paragraph (j)(7) should require mending plates on all spliced wooden poles. One commenter (Ex. 2-13) wanted the Agency to prohibit the splicing of wood poles used for pump jack scaffolds. His explanation was that:

[t]here is no splice that can equal the strength of the total pole cross section. Wood pole lengths should be limited to commercially available lengths.

From my experience, at work sites across this nation, no one uses any but the top pole brace. All the more reason to eliminate splicing to gain added pole lengths.

The same commenter added "[t]he vast majority of the accidents involving pump jack scaffolds are caused by pole failure at a splice".

Another commenter (Ex. 2-31) said that a mending plate addresses the typical way a wooden pole breaks, i.e., laterally. He added that in-house tests conducted by his firm showed that poles with the plates are three times stronger than those without them, and went on to say that the cost factor for plate use is negligible. The ACCSH also recommended that mending plates be used on all splices (Tr. 6/9/87, pp. 95-96).

Based on its review of the comments and its knowledge of pumpjack scaffolds, OSHA has determined that mending plates provide an appropriate increase in the strength of spliced poles, and final rule paragraph (j)(7) reflects this determination. OSHA also believes that requiring wood poles to be made entirely of one piece of wood (i.e., no splices) would not be realistic because many contractors use this type of scaffold and splices with mending plates are at least as strong as unspliced wood. Although OSHA is aware that splices are potential weak points in a pole, the Agency finds that mending plates provide assurance that the spliced pole has adequate strength.

Several commenters (Exs. 2-23, 2-31 and 2-52) suggested that the final rule include the general requirements applicable to pump jack scaffolds found in this section of OSHA's existing scaffold standard. However, the final rule sets out general requirements for all scaffolds, including pump jack scaffolds, in § 1926.451, and OSHA has therefore not made the suggested change.

#### Paragraph (k) Ladder Jack Scaffolds

Paragraph 1926.452(k) of the final rule provides additional requirements for ladder jack scaffolds. Paragraph (k)(1) provides that platforms shall not exceed a height of 20 feet (6.1 m). This provision, which is identical to that in the proposed rule, is based on existing § 1926.451(s)(1) and current safe industry practice.

Paragraph (k)(2) requires that all ladders used to support ladder jack scaffolds meet the requirements of subpart X of 29 CFR part 1926—Stairways and Ladders, except that job-made ladders, which are permitted by subpart X, are not permitted to be used to support ladder jack scaffolds. This provision, which is identical to the parallel requirement in the proposed rule, is consistent with existing § 1926.451(s)(2). The existing standard referenced two national consensus standards which, as subsequently updated, have been incorporated into the pertinent provisions of subpart X. In particular, existing § 1926.451(s)(2) implicitly prohibited the use of job-built ladders.

Two commenters (Exs. 2-20 and 2-55) opposed the proposed prohibition on the use of job-made ladders as ladder jack scaffold support, and stated that job-made ladders constructed according to proposed § 1926.1053 (subpart X) could serve as adequate supports for ladder jack scaffolds. However, OSHA concludes, based on the record and the Agency's experience in the construction

industry, that job-made ladders that comply with the requirements of § 1926.1053 may not be able to support the heavy point loading imposed by ladder jack scaffold brackets. OSHA has therefore determined that the use of a job-made ladder to support a ladder jack scaffold could lead to scaffold collapse, and the final rule reflects this finding. OSHA's final rule is thus consistent on this point with the position taken by the corresponding ANSI standard, A10.8-1988, paragraph 17.2.2, which provides that only manufactured ladders may be used to support ladder-type scaffolds or platforms.

Paragraph (k)(3) provides that the ladder jack be so designed and constructed that it will bear either on the side rails and ladder rungs or on the ladder rungs alone. This paragraph further requires that the bearing area for a ladder jack that bears only on the rungs shall be at least 10 inches (25.4 cm) on each rung to ensure adequate support. This provision, which is identical to that in the proposed rule, is effectively identical to existing § 1926.451(s)(3).

Paragraph (k)(4) requires that ladders used to support ladder jacks be placed, fastened, or equipped with devices to prevent slipping. This provision, which is identical to that in the proposed rule, is effectively identical to existing § 1926.451(s)(4) and is intended to prevent employee falls caused by displacement of the ladder.

Paragraph (k)(5) provides that scaffold platforms shall not be bridged one to another. This paragraph, which is identical to the proposed requirement, is a new requirement that is intended to ensure the stability of the system and to prevent accidental overloading. The provision would prohibit situations where, for example, four ladders are used to support three platforms. OSHA is prohibiting bridging because this practice often leads to overloading of the two ladders in the middle. This provision does not prohibit passage from one scaffold to another if the scaffolds are close enough for employees to walk (but not to jump or swing) from one scaffold to the other.

Three commenters [Exs. 2-23, 2-367, and 2-368] urged OSHA to include specific language in the final rule addressing acceptable dimensions and loading of ladder jack scaffolds. OSHA has not made the suggested revisions because the Agency believes that the capacity requirements found in final rule § 1926.451(a) adequately address these matters.

Another commenter (Ex. 2-308) recommended that ladder jack scaffolds be prohibited because they "cannot be

secured at the top," safe access is not possible, and an anchorage for attaching a lifeline or lanyard is not available. Although the Agency agrees that the conditions described by this commenter may occur in some construction situations, they are not characteristic of ladder jack scaffolds per se. Employers using ladder jack scaffolds must still comply with the applicable general requirements of § 1926.451, such as those addressing capacity, access and fall protection, i.e., the three situations mentioned by the commenter. In particular, employees working on ladder jack scaffolds must be protected from fall hazards by personal fall arrest systems which comply with the criteria set in subpart M, § 1926.502(d) (Fall protection) (final rule § 1926.451(g)(1)(ii)). Ladder jack scaffolds which do not comply with those requirements must not be used.

Based on the rulemaking record and the Agency's own experience, OSHA has determined that ladder jack scaffolds used in compliance with the requirements of the final rule provide acceptable and safe working surfaces for employees. Accordingly, the final rule does not prohibit the use of ladder jack scaffolds.

#### Paragraph (l) Window Jack Scaffolds

Paragraph (l) of the final rule provides additional requirements for window jack scaffolds. This paragraph provides that window jack scaffolds shall be securely attached to the window opening (paragraph (l)(1)), shall be used only for the purpose of working at the window opening through which the jack is placed (paragraph (l)(2)) and shall not be used to support planks placed between one window jack and another, or to support other elements of scaffolding. These requirements are necessary to ensure the safety of employees working from these platforms.

These provisions of the final rule are identical to the corresponding proposed provisions. Paragraph (l)(1) is a new requirement, and is intended to ensure that the scaffold is not accidentally displaced. Final rule paragraphs (l)(2) and (l)(3) are identical to existing §§ 1926.451(t)(1) and (t)(2), respectively.

#### Paragraph (m) Crawling Boards

Paragraph (m) of the final rule provides additional requirements for crawling boards (chicken ladders). The final rule requires that crawling boards extend from the roof peak to the eaves when used in connection with roof construction, repair, or maintenance (paragraph (m)(1)), and that crawling boards be secured to the roof by ridge

hooks or by means which satisfy equivalent criteria (e.g., strength and durability) (paragraph (m)(2)). These requirements are designed to ensure that crawling boards used by employees performing roof work are as secure as possible.

The provisions of the final rule, which are effectively identical to those of the proposed paragraph, are based on requirements in existing §§ 1926.451(v)(1) and (3), respectively. The other provisions of existing § 1926.451(v)(1) are being relocated to non-mandatory Appendix A since they have been replaced by the capacity requirements of revised § 1926.451(a)(1). The existing rule's requirement to clinch nails has been deleted because the inaccessibility of many nail points makes clinching impossible. Existing § 1926.451(v)(2) is being replaced by the fall protection requirements of revised § 1926.451(e)(1).

#### Paragraph (n) Step, Platform, and Trestle Ladder Scaffolds

Paragraph (n) of the final rule provides additional requirements for step, platform, and trestle ladder scaffolds. The provisions of final rule paragraph (n) are virtually identical to the provisions of the proposed paragraph.

Paragraph (n)(1) provides that scaffold platforms not be placed any higher than the second highest rung or step of the ladder supporting the platform. This provision is consistent with paragraphs 17.4 and 17.5 of ANSI A10.8-1988, and is intended to ensure the stability of this type of scaffold.

Paragraph (n)(2) requires that all ladders used in conjunction with step, platform and trestle ladder scaffolds meet the requirements of subpart X of 29 CFR part 1926—Stairways and Ladders, except that job-made ladders must not be used to support such scaffolds. A commenter (Ex. 2-23) suggested that ladders used in conjunction with step, platform and trestle ladder scaffolds be required to comply with subpart X or with the pertinent ANSI standards. The commenter also suggested that OSHA prohibit the use of job-made ladders to support such scaffolds. Final rule paragraph (n)(2), which is identical to the proposed paragraph, addresses both of these concerns.

Paragraph (n)(3) provides that ladders used to support step, platform, and trestle ladder scaffolds shall be placed, fastened, or equipped with devices to prevent slipping. Paragraph (n)(4) requires that scaffolds not be bridged one to another. Bridging, as discussed above under paragraph (k)(5), occurs when four ladders are used to support

three platforms. OSHA is prohibiting bridging because this practice often leads to overloading of the two ladders in the middle. Although step, platform and trestle ladder scaffolds were not specifically addressed in OSHA's existing scaffold rule, they are covered by the general requirements in existing rule § 1926.451(a).

Final rule paragraphs (n) (2), (3), and (4) correspond to the ladder jack scaffold provisions in final rule § 1926.451(k) (2), (4) and (5), respectively. The "ladder-type" scaffolds covered by paragraph (n) differ from ladder jack scaffolds in that the platform rests directly on the ladder step or rung, whereas ladder jack scaffold platforms rest on brackets.

#### Paragraph (o) Single-point Adjustable Scaffolds

Paragraph (o) provides additional requirements for single-point adjustable scaffolds. This paragraph combines existing § 1926.451(k), single-point adjustable suspension scaffolds, and § 1926.451(l), boatswains' chairs, because boatswains' chairs are a form of single-point adjustable suspension scaffold. One commenter (Ex. 2-23) opposed the combining of these paragraphs from the existing rule because they [boatswains' chairs and other single-point adjustable scaffolds] "have different requirements because of the different positions in which the rider rides." OSHA has determined, however, that the characteristics of single-point adjustable suspension scaffolds and boatswains' chairs are sufficiently similar so that the requirements of final rule paragraph (o), along with the general requirements in § 1926.451, appropriately address both types of scaffolds.

Paragraph (o)(1) provides, when two single-point adjustable suspension scaffolds are combined to form a two-point adjustable suspension scaffold, that the resulting scaffold meet the requirements for two-point adjustable suspension scaffolds in final rule paragraph (p). This provision, which is identical to the proposed paragraph, is based on existing § 1926.451(k)(6).

Paragraph (o)(2) addresses the circumstances under which the supporting rope between a scaffold and a suspension device is permitted to deviate from a vertical position (i.e., at a 90 degree angle from level grade). This paragraph requires that the supporting rope between the scaffold and the suspension device be kept vertical unless the following four conditions are met: the rigging must have been designed by a qualified person; the scaffold must be accessible to rescuers;

the supporting rope must be protected to ensure that it will not chafe at any point where a change in direction occurs; and the scaffold must not be able to sway into another surface. Whenever swaying of the scaffold could bring the scaffold into contact with another surface, the supporting rope must be vertical, with no exceptions.

Proposed paragraph 1926.452(o)(2) required that supporting ropes be vertical and be kept from swaying, except where the scaffold is on the outside of a dome-like or slanted structure and the appropriate supports have been designed and installed. NPRM Issue 10 noted that existing § 1926.451(k)(7) requires the support rope for single-point adjustable suspension scaffolds to be vertical. OSHA asked if the exception provided by proposed paragraph (o)(2) was appropriate. The Agency further requested suggestions regarding a maximum permissible angle and any other conditions that needed to be specified.

The AGC (Exs. 2-20, 2-55, and 2-390) stated that "[a]ngles that are too severe would impair work operation and thus preclude the use of suspensions." Another commenter (Ex. 2-69) echoed that view, and added that "[f]lexibility is needed for certain operations when using suspended scaffolds." A manufacturer (Ex. 2-43) mentioned skylight and barrel-vault work as examples of situations which preclude the use of vertical lines. The commenter also stated " \* \* \* when suspended, the worker must be accessible to rescuers. One can envision a worker dangling in space below a dome with no way to get to him."

Another commenter (Ex. 2-64) stated "[t]he supporting rope for single-point adjustable suspension scaffolds *should* be allowed to deviate from vertical without defining any maximum limits. Each situation under these conditions is a special case and has its own limiting circumstances. It would not be feasible to establish standard limits for all possible special situations." (emphasis in original)

Another commenter (Ex. 2-22) stated that deviation from vertical should be permitted. The commenter further stated "[t]he same practical field problems arise in the case of a curved surface of any type as does in the case of the dome-type or slanted structure. There is no safety difference in the three special situations and they require an exception because of their unique character."

One commenter (Ex. 2-13) stated as follows:

There never was a reason for the suspension rope for a single point suspension scaffold to be vertical. In fact, most are used with the rope other than vertical. The same applies for two point suspension scaffolds. There is no maximum or minimum angle of deviation from the vertical. The load reaction to the rope does not change; but the rope(s) must be protected from sharp edges at the change in direction.

In addition, the SSFI and the SIA (Exs. 2-367 and 2-368) addressed this issue in their comments on proposed 1926.452(o)(2). They recommended that, when a scaffold is on the outside of a dome-type, slanted or set-in structure, the use of intermediate supports to change the direction of the rope from the vertical be allowed provided that such supports have been designed by a competent person and have been installed in a manner that prevents chafing of the rope.

The SIA (Ex. 2-368) commented that "[m]any work operations require non-vertical lines due to set-backs, curved surfaces, areas under soffits, following a bowser line, spherical water tanks, etc." In addition, the SSFI responded to Issue 10 as follows "[t]he SSFI agrees that some deviation from vertical support should be allowed. Cases in which this would occur are special in nature and should only be allowed when designed by a competent person."

The ACCSH (Tr. 96-97, 6-9-87) recommended that deviation from vertical should be allowed only under the supervision of a "qualified person." A member of the ACCSH stated that the qualified person would be "a competent design engineer that has experience in this discipline."

OSHA agrees that there are circumstances where the support lines of single-point adjustable suspension scaffolds need to deviate from vertical, and that under controlled circumstances, the swaying of support lines should be allowed. The Agency concludes that the requirements for design by a qualified person, accessibility to rescuers, protection of supporting rope from chafing, and prohibition of swaying where the scaffold could contact another surface are appropriate measures, and final rule paragraph (o)(2) reflects this determination.

Paragraph (o)(3) requires that the tackle used with boatswains' chairs be ball bearing or bushed blocks containing safety hooks and properly "eye" spliced minimum five-eighth (5/8) inch (1.6 cm) diameter first grade manila rope, or other rope that meets the performance criteria of the above-specified manila rope. The proposed provision, based on existing § 1926.451(l)(5), was effectively

identical, except that it did not specifically address the hook used to suspend the boatswains' chair. OSHA recognizes that the use of an open hook could allow a chair to be dislodged if the rigging hung up on an obstruction. The corresponding ANSI standard, A10.8-1988, paragraph 6.14.5, provides for the use of a hook with a safety latch over the opening (safety hook) to prevent dislodging of the chair. The Agency agrees that it is appropriate to explicitly require that employers who have their employees use boatswains' chair rig their scaffolds with safety hooks and has revised the proposed rule accordingly. In addition, OSHA believes that locking safety hooks, such as are required for use with crane and derrick suspended personnel platforms (§ 1926.550(g)(4)(iv)(B)), would provide the most effective protection for affected employees. A minor editorial revision to the proposed paragraph replaces the phrase "or equivalent" with language which states clearly that any rope used in lieu of 5/8 inch diameter first grade manila rope must, at least, satisfy the final rule's criteria (e.g., strength and durability) for manila rope.

Paragraph (o)(4) provides that boatswains' chair seat slings be reeved through four corner holes in the seat; shall cross each other on the underside of the seat; and shall be rigged so as to prevent slippage which could cause an out-of-level condition. This paragraph, which is identical to the proposed provision and is based on existing § 1926.451(l)(2), is intended to prevent tipping of the chair.

Paragraph (o)(5) requires, except as provided in paragraph (o)(6), that boatswains' chair seat slings be a minimum of five-eighth (5/8) inch (1.6 cm) diameter fiber or synthetic rope or other rope which satisfies equivalent performance criteria. This provision, which is substantively identical to the proposed provision, is based on existing § 1926.451(l)(2). A minor editorial revision to the proposed paragraph replaces the phrase "or equivalent" with language which states clearly that any rope used in lieu of 5/8 inch diameter fiber or synthetic rope must, at least, satisfy the final rule's criteria (e.g., strength, slip resistance, and durability) for fiber or synthetic rope. In addition, the final rule has deleted the proposed language "when employees are not using a heat-producing process such as gas or arc welding" as being unnecessary since final rule paragraph (o)(6) specifically addresses the issue of rope use when heat producing processes are in operation.

Paragraph (o)(6) requires that boatswains' chair seat slings be a

minimum of three-eighth ( $\frac{3}{8}$ ) inch (1.0 cm) wire rope, when a heat-producing process such as gas or arc welding is being conducted. This provision, which is substantively identical to the proposed provision and is based on existing § 1926.451(l)(3), is necessary to ensure that the chair's sling is made of fire-resistant materials.

Paragraph (o)(7) requires that non-cross-laminated wood boatswains' chairs be reinforced on their underside by cleats securely fastened to prevent the board from splitting. This provision is identical to the proposed provision. Existing § 1926.451(l)(1) requires all boatswains' chairs to be cleated. As noted in the preamble to the proposed rule (51 FR 42694), this paragraph recognizes that plywood-type wood seats which comply with § 1926.451(a)(1) are strong enough to use as boatswains' chairs without being reinforced with cleats.

#### Paragraph (p) Two-point Adjustable Suspension Scaffolds (Swing Stages)

Paragraph (p) provides additional requirements for two-point adjustable suspension scaffolds (swing stages). The introduction to this paragraph states that paragraph (q) addresses stonemasons' multi-point adjustable suspension scaffolds, masons' multi-point adjustable suspension scaffolds or other multi-point suspension scaffolds.

Paragraph (p)(1) provides that platforms not be more than 36 inches (0.9 m) wide unless designed by a qualified person to prevent unstable conditions. This provision, which is identical to proposed paragraph (p)(1), is essentially the same as existing § 1926.451(i)(1), which limits platform width to 36 inches.

A commenter (Ex. 2-23) recommended that such platforms "not be less than 20 inches nor more than 36 (0.9 m) inches wide unless designed by a registered civil or mechanical engineer to prevent unstable conditions." OSHA has not adopted the commenter's recommendation for a 20-inch minimum width, because the Agency considers the 18-inch minimum platform width set in final rule § 1926.451(b)(2) to be adequate. In addition, OSHA has not adopted a requirement for a platform wider than 36 inches to be designed by a registered engineer, because the Agency believes that a person who is "qualified" as defined in both § 1926.450(b) and § 1926.32(m) will have the skills and expertise needed to design such a platform.

Paragraph (p)(2) requires that the platform be securely fastened to hangers (stirrups) by U-bolts or other means

which satisfy § 1926.451(a). This provision is based on existing § 1926.451(i)(1). Proposed paragraph (p)(2) has been editorially revised to replace the term "equivalent means" with language which indicates clearly that "other" means of fastening the platform to hangers must satisfy the criteria of § 1926.451(a).

Paragraph (p)(3) provides that the blocks for fiber or synthetic ropes consist of at least one double and one single block, and that the sheaves of all blocks fit the size of the rope used. This provision, which is identical to the proposed provision and is based on existing § 1926.451(i)(6), is intended to ensure that these types of rope are maintained under proper tension and do not slip out of their sheaves.

Paragraph (p)(4) requires that platforms be of the ladder-type, plank-type, beam-type, or light-metal type. Light metal-type platforms having a rated capacity of 750 pounds or less and platforms 40 feet (12.2 m) or less in length shall be tested and listed by a nationally-recognized testing laboratory. This provision is based on existing § 1926.451(i)(10). Proposed paragraph (p)(4) was similar to this provision of the final rule, except that the final rule excludes platforms rated over 750 pounds or platforms longer than 40 feet. This revision has been made based on a comment (Ex. 2-539) which stated:

Underwriters' Laboratories has issued a standard for safety called UL 1322 covering fabricated scaffold stages. This standard covers stage platforms with loads up to 750 pounds and lengths up to 40 feet. They do not have standards covering heavier loads or longer lengths. It is not practical to have a requirement for UL testing and approval on products that UL arbitrarily refuses to test or approve.

The Agency notes that the 1994 edition of UL 1322 has the same limits cited by the commenter, and agrees with the commenter that it is not realistic to require testing and approval of a product that nationally-recognized testing laboratories do not test or approve.

Proposed paragraph (p)(5) provided that two-point suspension scaffolds be securely lashed to the building or structure to prevent them from swaying. The paragraph further required that window cleaners' anchors not be used for this purpose. The requirement now appears in final rule § 1926.451(d)(18) and is applicable to all multi-point suspended scaffolds. The provision is based on existing § 1926.451(i)(9).

Final paragraph (p)(5), proposed as paragraph (p)(6), requires that two-point scaffolds not be bridged or otherwise connected one to another during raising

and lowering operations unless the bridge connections are articulated and the hoists properly sized. This paragraph is similar to the proposed paragraph, except for editorial revisions made for clarity. No comments were received on this provision.

OSHA notes that paragraph (p)(5) is not intended to prohibit passage from one scaffold to another, but to prevent significant overloading of the hoist nearest the bridging device during operation of the hoist, or displacement of the bridge if the hoist is used to raise or lower one of the scaffolds. Many hoists are only sized to support one end of a two-point system. If one of two bridged scaffolds were to be raised by a hoist, a bridge laid between the scaffolds could be displaced unless the bridge is articulated (connected). This could also significantly increase the load on the hoist if it is not properly sized. The final rule addresses these two hazards by requiring bridge connections to be articulated and requiring that hoists be properly sized. These requirements thus allow for properly engineered solutions.

Final rule paragraph (p)(6), identical to proposed paragraph (p)(7), is a new requirement. It allows passage from one platform to another only when the platforms are at the same height, when the platforms abut each other, and when walk-through stirrups specifically designed for this purpose are used.

#### Paragraph (q) Multi-point Suspension Scaffolds, Stonemasons' Multi-point Adjustable Suspension Scaffolds, and Masons' Multi-point Adjustable Suspension Scaffolds

Paragraph 1926.452(q) of the final rule provides additional requirements for multi-point suspension scaffolds, stonemasons' multi-point adjustable suspension scaffolds, and masons' multi-point adjustable suspension scaffolds. This paragraph combines and clarifies the provisions of existing § 1926.451(h), stonemasons' adjustable multi-point suspension scaffolds, and existing § 1926.451(j), masons' adjustable multi-point suspension scaffolds, and indicates clearly that paragraph (q) applies to other multi-point adjustable suspension scaffolds as well.

Paragraph (q)(1) provides that, when two or more scaffolds are used, they shall not be bridged one to another unless they are designed to be bridged, the bridge connections are articulated (connected), and the hoists are properly sized. This paragraph of the final rule, which is identical to proposed paragraph (q)(1), is based on the same concerns about displacement of the

bridge and hoist overloading that resulted in final rule § 1926.452(p)(5).

Paragraph (q)(2) provides that, if bridges are not used, passage may be made from one platform to another only when the platforms are at the same height and are abutting. This provision, which is essentially identical to that in the proposed rule, is based on the same concerns that resulted in final rule § 1926.452(p)(6). OSHA has editorially revised proposed paragraph (q)(2) to delete the word "closely" because that word is redundant with the word "abutting."

Paragraph (q)(3) requires that scaffolds be suspended from metal outriggers, brackets, wire rope slings, hooks, or equivalent means. This provision, which is essentially identical to the corresponding requirement in the proposed rule, is virtually the same as existing § 1926.451(j)(4), which addresses stonemasons' adjustable multi-point suspension scaffolds. OSHA has deleted the word "iron" from the proposed language, based on comments from the SSFI and the SIA (Exs. 2-367 and 2-368) stating that it is appropriate to have brackets or hooks fabricated from material other than iron. OSHA agrees with this point and concludes that employees on these scaffolds will be adequately protected by brackets or hooks made of other materials, as long as those components satisfy the strength criteria set in final rule § 1926.451(a)(1). The final rule reflects this conclusion.

#### Paragraph (r) Catenary Scaffolds

Paragraph 1926.452(r) of the final rule provides additional requirements for catenary scaffolds. In OSHA's existing scaffold standard, catenary scaffolds were addressed only by the general provisions applicable to all scaffolds. The new provisions in paragraph (r) thus address specific concerns not directly addressed by the existing standard. These provisions are identical to proposed § 1926.452(r).

Paragraph (r)(1) allows no more than one platform to be placed between consecutive vertical pickups, and no more than two platforms to be used on a catenary scaffold. These requirements are intended to prevent overloading of this type of scaffold. This paragraph is consistent with the corresponding provision of ANSI A10.8-1988, paragraph 20.4.

Paragraph (r)(2) requires that platforms supported by wire ropes have hook-shaped stops on each end of the platforms to prevent the platforms from slipping off the wire ropes. These hooks shall be so placed that they will prevent the platforms from falling if one of the horizontal wire ropes breaks. This

language is consistent with the corresponding provision of ANSI A10.8-1988, paragraph 20.1.

Paragraph (r)(3) of the final rule provides that wire ropes shall not be tightened to the extent that the application of a scaffold load will overstress them. This provision is consistent with the corresponding language of ANSI A10.8-1988, paragraph 20.2.

Paragraph (r)(4) requires that wire ropes be continuous and without splices between anchors. This language is consistent with the corresponding language in ANSI A10.8-1988, paragraph 20.2, and is necessary to ensure that the rope has sufficient integrity to handle the load.

#### Paragraph (s) Float (Ship) Scaffolds

Paragraph (s) provides additional requirements for float (ship) scaffolds. These provisions are identical to those in proposed § 1926.452(s), which were based on existing § 1926.451(w) (3) and (5).

Paragraph (s)(1) requires that the platform be supported by a minimum of two bearers, each of which shall project a minimum of six inches (15.2 cm) beyond the platform on both sides. This will ensure that the platform will be fully supported. In addition, each bearer shall be securely fastened to the platform to prevent slippage.

Paragraph (s)(2) provides that rope connections shall be such that the platform cannot shift or slip. Platform slippage is a significant factor in scaffold accidents.

Paragraph (s)(3) provides that, when only two ropes are used with each float, those ropes shall be arranged so as to provide four ends which are securely fastened to overhead supports, and each supporting rope shall be hitched around one end of the bearer and pass under the platform to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties. This requirement is necessary to ensure that the supporting ropes are properly attached to both the platform and to the overhead support to prevent the scaffold from falling. These requirements are designed to ensure safe use of these commonly used job-built scaffolds.

#### Paragraph (t) Interior Hung Scaffolds

Paragraph (t) provides additional requirements for interior hung scaffolds. These provisions are identical to those of the proposed paragraph. Paragraph (t)(1) requires that scaffolds be suspended only from the roof structure or other structural members such as ceiling beams. This requirement is

necessary to ensure that these suspended scaffolds are supported by structural members with adequate capacity for safe use. This is the same requirement as existing § 1926.451(r)(1).

Paragraph (t)(2), which is a new provision, requires that the supporting members be inspected and checked for strength before the scaffold is erected. This requirement is necessary because such points of support cannot be assumed to be strong enough to support a scaffold since they may already be loaded to their capacity or they may have deteriorated over time. This provision is consistent with ANSI A10.8-1988, paragraph 16.7.

Paragraph (t)(3) provides that suspension ropes and cables be connected to the overhead supporting members by shackles, clips, thimbles, or by other means which provide equivalent strength, security and durability. This paragraph of the final rule (identical to the proposed paragraph) deletes the specific connection requirements of existing § 1926.451(r)(2), which OSHA determined were obsolete, and specifies criteria that OSHA has found to be current safe practice. The strength requirement of existing § 1926.451(r)(2) is now covered by final rule paragraph § 1926.451(a)(3), which specifies strength criteria for suspension ropes on all types of scaffolds.

#### Paragraph (u) Needle Beam Scaffolds

Paragraph (u) of the final rule provides additional requirements for needle beam scaffolds. These provisions are identical to proposed paragraph 1926.452(u) except for minor editorial revisions. Paragraph (u)(1) requires that scaffold support beams be installed on edge. This provision is based on existing § 1926.451(p)(1), and is necessary to ensure that support beams are installed in a way that maximizes their strength.

Paragraph (u)(2) provides that ropes or hangers be used for supports, except that one end of a needle beam scaffold may be supported by a permanent structural member. This provision is based on existing §§ 1926.451(p)(2) and (8), and is necessary to ensure that these scaffolds are properly supported by rope or hangers that meet the strength criteria of § 1926.451(a).

Paragraph (u)(3) requires that the ropes be securely attached to the needle beams. This is a change from existing § 1926.451(p)(3), which specified that all rope attachments must be either a scaffold hitch or properly made eye splices. OSHA determined that the existing rule is too restrictive, because other knots and means of attachment, such as wire rope clips, can adequately

support the scaffold without decreasing employee safety.

Paragraph (u)(4) provides that the support connection be arranged so as to prevent the needle beam from rolling or becoming displaced, which could result in tipping of the platform. This provision is based on existing § 1926.451(p)(4).

Paragraph (u)(5) provides that platform units shall be securely attached to the needle beams by bolts or equivalent means. In addition, cleats and overhang are not considered to be adequate means of attachment. Final rule paragraph (u)(5) clarifies the requirements of existing § 1926.451(p)(6), which only required that planks be secured against slipping. Also, under the existing rule, cleats and overhang could be used to secure the units. As stated in the preamble to the NPRM (51 FR 42695), OSHA has concluded that cleats or overhang do not adequately secure platform units to needle beam scaffolds, because needle beam scaffolds have a tendency to twist, and cleats and overhangs used to secure platforms will not provide sufficient means of holding the platforms. This could result in platforms coming loose and falling.

#### Paragraph (v) Multi-level Suspended Scaffolds

Paragraph 1926.452(v) of the final rule provides additional requirements for multi-level suspended scaffolds. These scaffolds are suspended scaffolds with more than one working level. The provisions of paragraph (v) are identical to those in the proposed paragraph, except for minor editorial changes. Although these types of scaffolds are not specifically addressed in the existing standard, they are covered by the general requirements in existing § 1926.451. The new provisions address concerns not covered by the existing standard or by final rule § 1926.451.

Paragraph (v)(1) requires that multi-level suspended platform scaffolds be equipped with additional independent support lines, equal in number to the number of points supported and of equivalent strength to the suspension ropes, and be rigged to support the scaffold in the event the suspension rope(s) fail. These additional lines would support the scaffold, and prevent collapse in the event of primary support line failure.

Paragraph (v)(2) provides that the independent support lines and suspension ropes shall not be attached to the same points of anchorage. This provision reflects OSHA concern that the independent support lines would not protect workers from scaffold

collapse if the independent lines and the suspension ropes were attached to the same anchorage point when the anchorage failed.

Paragraph (v)(3) requires that supports for platforms be attached directly to the support stirrup and not to any other platform. This provision is intended to protect against platform overloading.

#### Paragraph (w) Mobile Scaffolds

Paragraph (w) provides additional rules for mobile scaffolds. This paragraph consolidates and clarifies the provisions of existing § 1926.451(e) and existing § 1926.453. This paragraph applies to all mobile scaffolds, not just to those which are manually propelled. This paragraph of the final rule is effectively identical to that in the proposed rule, except as discussed below.

Paragraph (w)(1) provides that scaffolds shall be braced by cross, horizontal, or diagonal braces, or combination thereof, to prevent racking or collapse of the scaffold and to secure vertical members together laterally so as to automatically square and align the vertical members. In addition, scaffolds shall be plumb, level, and squared. All brace connections shall be secured. This paragraph also provides that scaffolds constructed of tube and coupler components shall conform to the requirements of § 1926.452(b) (paragraph (w)(1)(i)), and that scaffolds constructed of fabricated frame components shall conform to the requirements of § 1926.452(c) (paragraph (w)(1)(ii)). The provisions of paragraph (w)(1) are substantively identical to the corresponding provisions in existing §§ 1926.451(e)(3) and (e)(9).

Paragraph (w)(2) requires that scaffold casters and wheels be locked with positive wheel and/or wheel and swivel locks, or equivalent means, to prevent movement of the scaffold while the scaffold is used in a stationary manner. This provision is effectively identical to existing § 1926.451(e)(8).

Paragraph (w)(3) provides that manual force used to move the scaffold shall be applied as close to the base as practicable, but not more than five feet (1.5 m) above the supporting surface. This paragraph is essentially the same as existing § 1926.451(e)(6), which required that propelling forces be applied as close to the base as possible. However, the final rule limits the height at which the force can be applied to 5 feet above the supporting surface, to minimize overturning forces. One commenter (Ex. 2-23) recommended that scaffolds not be moved manually unless the propelling force is applied to

the wheels only. Although such a requirement may be appropriate for powered scaffolds, the Agency sees no rationale for applying this provision to scaffolds being moved manually. OSHA has not adopted the suggested change because compliance would be unwieldy and would expose employees to hazards from the rolling wheels.

The proposed language has been modified in the final rule to indicate clearly that final paragraph (w)(3) applies only when mobile scaffolds are being moved manually. This provision is consistent with ANSI A10.8-1988, paragraph 11.3.1.

Paragraph (w)(4), which is a new provision, requires that power systems used to propel mobile scaffolds be designed for such use. In addition, forklifts, trucks, similar motor vehicles, or add-on motors shall not be used to propel scaffolds unless the scaffold is designed for such propulsion systems.

Paragraph (w)(5) requires that scaffolds be stabilized to prevent tipping during movement. This provision is effectively identical to the corresponding provision in existing § 1926.451(e)(6).

Paragraph (w)(6) provides that employees shall not be allowed to ride on scaffolds unless the following conditions exist:

1. The surface on which the scaffold is being moved shall be within three degrees of level, and free of pits, holes, and obstructions (paragraph (w)(6)(i));
2. The height-to-base width ratio of the scaffold during movement shall be two to one or less, unless the scaffold is designed and constructed to meet or exceed nationally-recognized stability test requirements (paragraph (w)(6)(ii));
3. Outrigger frames, when used, shall be installed on both sides of the scaffold (paragraph (w)(6)(iii));
4. When power systems are used, the propelling force shall be applied directly to the wheels, and shall not produce a speed in excess of one foot per second (0.3 mps) (paragraph (w)(6)(iv)); and
5. No employee is on any part of the scaffold which extends outward beyond the wheels, casters, or other supports (paragraph (w)(6)(v)).

These provisions are based in part on the provisions of existing § 1926.451(e)(7).

Proposed paragraph (w)(6)(ii) set the maximum height-to-base width ratio at two to one or less. OSHA has revised the proposed provision to allow a higher ratio when the scaffold is designed and constructed in accordance with nationally-recognized stability test requirements. This change is discussed in relation to Issue 4, below.

Proposed paragraph (x)(6)(iv) required that the propelling force be applied

directly to the wheels (not to the frame) when power systems are used to propel scaffolds, and limited the speed of the scaffold to 2 feet per second. The proposed provision was intended to protect against a scaffold toppling over should it strike an object.

One commenter (Ex. 2-423) stated as follows:

In our initial testing we tested several speeds including 2'/Sec and found these to be far too fast for an operator to drive through narrow areas and through debris that would be encountered on a construction site. With all the units sold by our company, I have never had anyone say the Motorized Scaffold (r) was too slow. I cannot speak for other means of propelling scaffold but we would not allow our Motorized Scaffold (r) to drive faster than one foot per second.

OSHA agrees that allowing motor-propelled scaffolds to drive faster than one foot per second could create problems for operators and has revised the rule accordingly.

Issue 4 raised a question regarding existing § 1926.451(e)(7)(ii), which required manually propelled mobile scaffolds to be not more than twice as high as they are wide when employees ride on them. The proposed rule, § 1926.452(w), extended this requirement to cover both manually propelled and motor-propelled mobile scaffolds. OSHA asked whether the final rule should raise the current ratio, 2:1, to 3:1 or higher on those systems which are built with a lower center of gravity, and, if so, what would be appropriate limitations.

The ACCSH discussed Issue 4 at length (Tr. 48-61, June 9, 1987). Several members expressed concern about employees riding mobile scaffolds while the scaffolds were being moved, regardless of the height-to-base ratio mandated. As OSHA explained to the Committee, scaffold equipment manufacturers had informed the Agency that a motor propelled mobile scaffold which exceeded the existing and proposed 2:1 ratio would be safe for use because the attachment of motor units would lower the center of gravity, thereby increasing the scaffold's stability (Tr. 52-53). Members of the Advisory Committee questioned the extent to which the weight of the motor unit would provide sufficient stability, citing concerns about the manner in which employers would calculate the height-to-base ratio using the weight of the motor unit and the extent to which wind or overhead power lines would pose hazards. Ultimately, the ACCSH voted to recommend simply that OSHA prohibit riding on mobile scaffolds (Tr. 61).

One commenter (Ex. 2-53) stated that the "existing rule on manually propelled mobile scaffolds" should not be extended to motor-propelled mobile scaffolds but did not explain why. The AGC commented (Exs. 2-20, 2-55, and 2-390) that "[i]n maintaining a performance-oriented standard, OSHA should provide for manufacturer's recommendations when movement of a rolling scaffold is required." These three comments further stated that OSHA should allow the use of those mobile scaffolds that have a lower center of gravity and thus have the capability "of being moved at a higher ratio." Another participant (Ex. 2-69) commented that "[W]hen movement of a rolling scaffold is required, OSHA should provide for use of manufacturers' recommendations in keeping with a performance-oriented approach."

One commenter (Ex. 2-70) stated that 3:1 ratio would be acceptable if the scaffold had a low center of gravity. Another commenter (Ex. 2-516) added a number of details and factors involved in calculating or arriving at a safe "gross ratio" for mobile scaffolds, and indicated that "higher ratios may be permitted in specific instances when operated under constant and continuous supervision, and when designed by qualified engineers." In particular, the commenter explained that the 2:1 ratio "is a minimum standard, established for *uniformity, simplicity, and safety*. Higher ratios can easily be achieved in given instances, but allowing those ratios to be in general use is unwise" (emphasis in the original). To illustrate the rationale behind this assertion, the commenter stated, in part, that:

There is a moment in each vertical rolling scaffold *leg* due to caster offset. This moment is increased when the wheel is stopped by a stone or curb, because the tower inertia then acts on the caster support as a force acting from the center of gravity of the tower, to the wheel.

The force from the 'pushing' and the inertia change depends on the weight of the scaffold, its velocity, how fast it stops, and how hard it is being pushed or driven. The moment felt at the scaffold leg depends on the force, the height of the center of gravity, the flatness of the rolling surface, whether only one wheel carries the load, and where on the scaffold it is being pushed.

The height of the center of gravity depends on how much load is put on top of the scaffold, and the height of the scaffold. [emphasis in original]

Another commenter (Ex. 2-50) stated that an extension of the ratio for some scaffolds should not be limited to 3:1. As an example, the commenter explained that "some motorized scaffolding, and batteries, hydraulics, and motors mounted low on the frame

are capable of reaching 20-30 feet high with their bases only 6 feet wide." The commenter, a representative from a building contractor's association, added that "the manufacturers test the machines extensively for upset."

One commenter (Ex. 2-15) stated "[e]ven the 2:1 is too permissive for small, light towers which are usually the most top[-]heavy, especially with a man on top. This provision is not enforceable. [It would be] better to forbid riding at all." Another commenter (Ex. 2-29) commented that "[i]ncreasing the height-to-base ratio of mobile scaffolds ridden by employees would expose employees to an unacceptable fall hazard." In addition, a commenter (Ex. 2-54) stated that "2 to 1 is a good ratio, as there is less chance of tipping over and a better chance for worker[s] to jump off [the] scaffold, and not get hurt, if [the] scaffold began to tip." The SSFI (Ex. 2-367) recommended that "under no circumstances should the 2:1 height-to-width ratio be raised to 3:1 for systems built with a 'lower center of gravity.' Tipping of rolling towers is one of the primary causes of accidents and no changes should be made."

The SSFI further stated that they have "always and will continue to recommend prohibiting riding rolling scaffolds." The commenter noted that "riding of motor[-]propelled scaffolds is especially hazardous as the scaffold is normally not designed for such loads. Motors should not be added to scaffold towers unless the towers are specially designed to accommodate those forces." Another commenter (Ex. 2-476), also holding the view that riding rolling scaffolds should not be allowed, recommended that:

Motorized means should not be attached to frame scaffold towers to promote riding. The 2 to 1 base-to-height ratio, which allows riding, is not being used by workers riding rolling towers, and workers are riding rolling towers with any base-to-height ratio. The scaffold frame rolling towers were not designed to be ridden, and were not designed for special add-on motors for propulsion.

Another commenter (Ex. 2-13) stated "[m]obile scaffolds should never be moved when occupied. The only time they are involved in accidents is when they are moved while occupied. To allow any but specifically designed scaffolds to be moved while occupied is totally unacceptable."

The SIA (Ex. 2-368) indicated that:

[M]any of our members advocate prohibiting riding of mobile scaffolds at any time. Others oppose such drastic action, since this would place undue hardship on those trades which perform a high percentage of their work on mobile scaffolds. The



alternative is to develop provisions for their safe use\* \* \* Motors should not be added to scaffold towers unless the towers are specifically designed to accommodate the increased forces exerted on the legs of the scaffold frames.

The SIA (Ex. 2-368) also stated that statistics they had developed over the past 10 years "indicate a high incidence of accidents on rolling scaffolds," and that "[i]t is our position that any raising of the 2:1 ratio would result in increased accidents."

A commenter (Ex. 2-476) stated that scaffold frames are not designed for the forces imposed on them by motors that are added on for propulsion. OSHA agrees with the commenters who raised concerns about the ability of scaffold frames to accommodate motors and has modified proposed § 1926.452(x)(6) accordingly.

OSHA agrees with the commenters who indicated that the riding of some mobile scaffolds can be hazardous. However, OSHA believes that the rulemaking record supports modification of the current regulations to allow greater use of mobile scaffolds for this purpose, provided additional appropriate precautions are taken.

The key concern in specifying the existing 2:1 ratio is stability of the scaffold. OSHA believes, based on the evidence submitted, that the existing 2:1 ratio is still the appropriate limit for all manually-propelled mobile scaffolds and has promulgated final rule paragraph (w)(6)(ii) accordingly.

OSHA also believes that, given appropriate engineering design, there are higher ratios which can be used safely on some power-propelled mobile scaffolds. As recommended by one commenter (Ex. 2-423), such designs must be proven to be safe, however, by subjecting the scaffold to stability tests such as the nationally recognized ANSI A92 tests used by the manufacturers of elevating and rotating work platforms. Where such tests have not been made, employees are not allowed to ride the scaffold. This, OSHA notes, does not preclude manufacturers or others from conducting or establishing such tests to demonstrate that a product meets appropriate stability criteria. The Agency believes that equipment meeting such tests and criteria should be permissible and has promulgated final rule paragraph (w)(6)(iii) accordingly.

OSHA also believes that compliance with the requirements of § 1926.451 and final rule paragraph (w)(6)(iv) (that the power be applied directly to the wheels and that the speed be limited to no more than 1 foot per second, as recommended by a commenter (Ex. 2-423)) adequately

addresses cases where a mobile scaffold is equipped with a motor.

Paragraph (w)(7), which is identical to the proposed paragraph, requires that platforms not extend outward beyond the base supports of the scaffold unless outrigger frames or equivalent devices are used to ensure stability. Compliance with this provision will prevent eccentric loading of the scaffold frame that could cause the scaffold to tip over.

Paragraph (w)(8) provides that, where leveling of the scaffold is necessary, screw jacks or equivalent means be used. This is a specific way of complying with § 1926.451(c)(2) of the final rule, which requires firm, level foundations. This provision is consistent with the corresponding provision in ANSI A10.8-1988, paragraph 11.1.4.

Paragraph (w)(9) requires that caster stems and wheel stems be pinned or otherwise secured to scaffold legs or adjustment screws. Proposed paragraph (w)(9) was identical, except that it did not specifically provide for the securing of stems to adjustment screws. This revision is based on input received on this provision from the SSFI and SIA (Exs. 2-367 and 2-368). OSHA agrees that adjustment screws provide appropriate attachment points for caster stems and wheel stems, so that specifically mentioning them in the final rule will clearly express the Agency's intent and facilitate compliance.

Paragraph (w)(10) provides that, before a scaffold is moved, employees on the scaffold shall be made aware of the move. This requirement, which was not part of the proposal, is based on input received from a commenter (Ex. 2-23) on this section. OSHA agrees with this input, and has revised the proposed paragraph accordingly. In addition, OSHA notes that this requirement is consistent with ANSI A10.8-1988, paragraph 11.2.3.5.

Issue 14 asked whether OSHA should allow mobile scaffolds to move only along their longitudinal axes while employees are riding on them. OSHA noted that compliance with this provision, which was suggested by ACCSH (Ex. 4), would maximize scaffold stability during movement, because tipping is more likely to occur when a scaffold is moved along its transverse axis.

Two commenters (Exs. 2-50 and 2-368) stated that such a provision would be difficult to enforce. Three commenters (Exs. 2-22, 2-53, and 2-368) also stated that this provision would be impractical. The SIA (Ex. 2-368) went on to explain that:

[S]uch a provision would make it difficult for workers to perform their duties without violating standards. Sometimes it is necessary to make even slight adjusting movement of the scaffold in order to reach the area of work. If workers were prohibited from moving the scaffold even the slightest amount along the narrow axis, they would tend to extend their reach over the side of the scaffold, thus creating an even greater hazard.

Some mobile scaffolds are almost square, which would require a tape measure to determine when there would be a violation. The fatigue created by the worker climbing up and down each time he wished to move the scaffold would tend to increase the likelihood of an accident.

Another commenter (Ex. 2-50) reasoned that it had never had a scaffold accident under the existing standards, so it expected that the proposed requirement would be unreasonably restrictive and difficult to monitor. Another commenter (Ex. 2-22) foresaw no increase in employee safety to balance against possible problems encountered by those required to implement the provisions.

On the other hand, one commenter (Ex. 2-29) simply favored adopting the suggested provision. Another commenter (Ex. 2-43) agreed that "rolling scaffolds should be moved in a safe manner" but added that "[e]nforcing this requirement will continue to provide special challenges."

Five commenters (Exs. 2-13, 2-15, 2-37, 2-54, and 2-367) found the provision unacceptable, because they felt employees should not be permitted to ride mobile scaffolds at all. Another commenter (Ex. 2-308), responding to proposed 1926.452(w), also said that employees should never be allowed to ride scaffolds. One other commenter (Ex. 2-13) agreed but added an exception for scaffolds "that have been specifically designed for such movement."

OSHA agrees with the SIA (Ex. 2-368), which indicated that such a requirement would make it difficult for workers to perform their duties without violating the standard because it would sometimes be necessary to make slight adjustments of a scaffold to safely reach the work area. OSHA is concerned that if workers were prohibited from moving the scaffold along its transverse axis, even slightly, they would find themselves in circumstances where they would extend their bodies over the side of the scaffold to reach a place where they need to perform work, instead of climbing down the scaffold to reposition it. This would create a greater hazard because the employee would be at risk of falling or of tipping the scaffold.

Accordingly, the Agency has not adopted the suggested language in the



final rule. OSHA believes the proposed provisions set forth in § 1926.452(w), Mobile Scaffolds, appropriately address the concerns of employees riding scaffolds.

#### (x) Repair Bracket Scaffolds

The March 29, 1993, Federal Register notice reopening the rulemaking record (58 FR 16509) sought information regarding "chimney bracket scaffolds." The Agency described such scaffolds as consisting of platforms supported by brackets which are secured in place by one or more wire ropes placed in an approximately horizontal plane around the circumference of the structure and tensioned by a turnbuckle. The Agency noted that it had recently received information (Exs. 31 and 32) which suggested that proposed § 1926.451 might not adequately protect employees on these scaffolds from falls and other hazards.

OSHA noted that it was considering whether specific fall protection requirements were needed in subpart L for protection of employees on chimney bracket scaffolds. The Agency also noted that it was considering the appropriateness of promulgating technical requirements for chimney bracket scaffolds that are more detailed than those proposed for scaffolds in general. Accordingly, the March 29, 1993, Federal Register notice presented a series of questions aimed at developing criteria for safe use of chimney bracket scaffolds. One commenter (Ex. 34-35) stated "[u]nless it can be determined by a competent person beforehand that the chimney can support a bracket and an independent safety line and fall protection is used, other means such as balling, explosives or remote crane suspended hydraulic attachments should be used." OSHA also received substantive input on chimney bracket scaffolds [repair bracket scaffolds] from one commenter, the National Advisory Committee for Health & Safety in the Chimney, Stack, Silo and Natural Draft Cooling Tower Industry (NACHS) (Ex. 34-33). Those comments are discussed below in relation to the pertinent provisions of the final rule. The NACHS, a trade association presenting the experience and views of companies which use the scaffolds in question, referred to these scaffolds as "repair bracket work platforms" in its comment. Based on that input, the Agency has determined that the term "repair bracket scaffold" should be used in place of the term "chimney bracket scaffold."

The NACHS (Ex. 34-33) indicated that a "repair bracket scaffold" is a type of supported scaffold that has been used

safely for over 80 years for tuckpointing on brick chimneys; crack repairs; the installation of bands on brick or concrete chimneys; painting; access to caps, hoods, and lightning protection systems; installation of permanent platforms; piece-meal demolition of brick, concrete, and steel chimneys; waterproofing brick and concrete chimneys; 360 degree access at any given elevation for any activity; and steeple access. According to the commenter, these scaffolds are installed by encircling a structure with a minimum one-half-inch diameter wire, tensioned by a minimum one-inch turnbuckle. Brackets are then placed over the wire rope, and scaffold planking (12-inch minimum width), guardrail posts and handrails are installed on the brackets.

Based on the information received, OSHA again reopened the rulemaking record (59 FR 4615, February 1, 1994) to solicit comment on draft regulatory text that the Agency was considering for inclusion in the final rule. In addition, the Agency noted that it was considering whether employees working on chimney bracket scaffolds needed to be protected from fall hazards by both a "Type I" guardrail, as would have been required by proposed § 1926.451(e)(4), and a personal fall arrest system. Also, OSHA noted that it was considering what provisions must be made for rescue of employees from chimney bracket scaffolds in the event of scaffold collapse or a medical emergency. The Agency indicated that it was developing criteria for employers who would need to comply with these provisions. As is discussed below in relation to the provisions of final rule paragraph (x), the Agency also raised Items (a) through (l) for consideration as prospective provisions of the final rule. (All references to Items and Issues in this paragraph of the preamble relate to the February 1, 1994 reopening notice.) The one commenter, Monsanto, (Ex. 43-45) who responded to those Items stated that they should be adopted in the final rule.

Based on the rulemaking record, OSHA has determined that it is appropriate to add a new paragraph (x) to § 1926.452 to address the use of 'repair bracket scaffolds'. In addition, a definition of that term, based on the NACHS comment, is being added to § 1926.450(b), Definitions.

Paragraph (x)(1) requires employers to secure brackets in place with 1/2 inch diameter wire rope that extends around the circumference of the chimney. This provision, which incorporates the language from Items (a) and (b) of the February 1, 1994 notice (59 FR 4617),

codifies established good industry practice as described by the NACHS (Ex. 34-33).

Final rule paragraph (x)(2) requires that each bracket be attached to the securing wire rope (or ropes) by a positive locking device capable of preventing the unintentional detachment of the bracket from the rope, or by some other means which prevents unintentional detachment. The NACHS (Ex. 34-33) indicated that brackets are positioned on the cable in the course of erecting the scaffold. Issue 6 asked if OSHA should require a positive locking device on the bracket hook that is placed over the wire rope to prevent unintentional separation of the bracket from the wire rope. Continental Chimney Inc. (CCI) and NACHS (Exs. 43-1 and 43-21) supported such a requirement.

Final rule paragraph (x)(3) requires that each bracket, at the contact point between the supporting structure and the bottom of the bracket, be provided with a "shoe" (heel block or foot) capable of preventing the lateral movement of the bracket. Issue 7 asked if OSHA should incorporate such a requirement in the final rule. CCI and NACHS (Exs. 43-1 and 43-21) commented that a "shoe" was needed to prevent lateral movement. In addition, CCI stated "The bottom of our [bracket] feet have an angle cut into them to prevent them from getting caught up on obstructions on the chimney and becoming disconnected if the scaffold system should slip."

Final rule paragraph (x)(4) requires that platform units be secured to brackets in a manner that prevents the separation of platform units from brackets and prevents movement of platform units or brackets on a completed scaffold. This provision is based on Item (e), which provided that platform units shall be secured to the brackets. Issue 4 asked how employers should fasten platform units to brackets so that they do not inadvertently detach. CCI (Ex. 43-1) stated "We have used 1/8" cable with 1/4" rope. 1/4" rope is enough most of the time. The 1/8" cable provides added security and can be secured adequately by tying it in right along side the 1/4" rope. Using clamps here would never work." The NACHS (Ex. 43-21) responded that employers should secure platform units to brackets "[b]y any positive system available, i.e., wire, rope, etc." OSHA has determined that it is appropriate to allow employers flexibility in choosing the means of securing platform units and has added final rule paragraph (x)(4) accordingly.

Final rule paragraph (x)(5) provides that, when a wire rope is placed around

a structure to provide safe anchorage for personal fall arrest systems that are used by employees erecting or dismantling repair bracket scaffolds, the wire rope shall be at least  $\frac{5}{16}$  inches in diameter and shall, in all other respects, satisfy the requirements of subpart M, OSHA's Fall Protection Standard. This paragraph, which is effectively identical to Item (l) of the February Notice, codifies established good practices as described by the NACHS (Ex. 34-33).

Final rule paragraph (x)(6) requires that each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems be protected from damage due to contact with edges, corners, protrusions, or other discontinuities of the supporting structure or scaffold components. Issue 10 of the Reopening Notice asked how employers protected wire ropes from abrasion. CCI (Ex. 43-1) stated "Our brackets hold the cable 3" below our decking." The NACHS (Ex. 43-21) responded "[t]he bracket scaffold support cable is static, and abrasion experienced from \* \* \* installation does not affect its integrity. The hardwood cable block spacers (@ [+ or -] 36" centers) minimize and often prevent the cable from making contact with the structure's surface." OSHA has determined, based on the comments, that adequate means of protecting wire rope from abrasion are readily available to affected employers.

Final rule paragraph (x)(7) provides that tensioning of each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems shall be by means of a turnbuckle at least 1 inch in diameter, or by some other equivalent means. This paragraph, which is very similar to Item (b) of the Reopening Notice, codifies established good practice as described by the NACHS (Ex. 34-33). OSHA has allowed employers the flexibility to use means other than a single turnbuckle for tensioning wire ropes, where the alternative means provide equivalent tension, because the Agency wants to encourage innovation and provide flexibility. In addition, OSHA anticipates, based on information from NACHS (Ex. 34-33), that there may be circumstances where more than one turnbuckle will be needed to tension the wire rope, depending on the diameter of the chimney.

Final rule paragraph (x)(8) requires that each turnbuckle be connected to the other end of its rope by use of a proper-size eyesplice thimble. Issue 8 of the February Notice asked if OSHA should add such a requirement to the final rule. CCI (Ex. 43-1) stated "Thimbles are very helpful in keeping the cable in good

condition. These can be fit over the turn buckle eye and then closed back up." Also, the NACHS (Ex. 43-21) commented that OSHA should add a requirement for the use of a proper size thimble.

Final rule paragraph (x)(9) provides that U-bolt wire rope clips shall not be used on any wire rope used to secure brackets or to serve as an anchor for personal fall arrest systems. OSHA expressed concern in the February 1, 1994 reopening notice that the use of U-bolt wire rope clips as wire rope fasteners on the horizontal support ropes could result in damage to the dead end of the rope. Further, if a segment of damaged dead end later were to become part of the live end due to an increase in the circumference of the structure, the Agency was concerned that the wire rope would be unable to support the loads imposed on it.

CCI responded (Ex. 43-1) "The use of U wire rope clips does not damage the wire rope significantly when they are not over-tightened. Double-saddle clips are not as strong as U wire rope clips and are difficult to put on the cable." Also, Charles Greene (Ex. 43-47), a safety consultant, stated he "[w]ould recommend that fist or saddle clips be used to fasten the horizontal support ropes that support the bracket scaffolds."

OSHA disagrees with CCI regarding the safety of using U-bolt wire rope clips, based on the Agency's review of *Rosnagles Handbook of Rigging* and the *Wire Rope User's Handbook*. The information in those publications clearly indicates that the use of U-bolt wire rope clips could significantly damage wire ropes. Where wire rope is used to secure brackets, U-bolt clips shall not be used because a segment of damaged dead end could later become part of the live end due to an increase in the circumference of the structure. By contrast, the standard allows U-bolts in other applications, such as where the U-bolt is used at the end (dead end) of the wire rope and that part of the wire rope is never moved into the live section. Accordingly, because of the risk of damaging the wire rope, OSHA is prohibiting the use of U-bolt wire rope clips on repair bracket scaffold support cables.

Final rule paragraph (x)(10) requires employers to ensure that materials are not dropped to the outside of the supporting structure. This paragraph is based on Item (j) of the February Notice. In addition, Issue 2 of the Reopening Notice asked if requirements other than those in proposed § 1926.451(f) (§ 1926.451(h) of the final rule) were needed to address the hazards of

materials falling to the outside of the structure. The NACHS (Ex. 34-33) indicated that chunks of material generated during demolition operations are "dropped piecemeal down the inside of the chimney and kept off the scaffold." There was no response to Issue 2. OSHA believes that this requirement simply codifies existing good industry practice and provides an appropriate supplement to the provisions of final rule § 1926.451(h).

Final rule paragraph (x)(11) requires that erection of a repair bracket scaffold be performed in only one direction around the structure. This provision is based on item (k); as with the other "items" from the February 1, 1994 notice, the Agency believes that this paragraph simply codifies established good industry practice.

In addition, the February 1, 1994 reopening notice raised several Issues and Items which did not result in the addition of requirements to the final rule. For example, Reopening Issue 1 asked how employers would provide a safe anchorage point for personal fall arrest systems and whether compliance with the General Industry standard for powered platforms, § 1910.66, Appendix C would be appropriate. The NACHS (Ex. 43-21) stated that a wire rope anchorage point could be attached to a structure "by means of tensioning devices i.e., turnbuckles and hardwood cable spacer (stand off) blocks." The commenter also stated that conformance with § 1910.66, Appendix C, should not be required "because the chimney bracket scaffold erector is secured to an independent anchor (ladder) during the installation process." Based on this information, OSHA has not added the cross-reference to the General Industry standard to the final rule.

In addition, Item (i) provided for a competent person to inspect the supporting structure before scaffold erection begins, and Issue 3 asked what criteria a competent person should apply when inspecting the supporting structure. The NACHS (Ex. 43-21) stated that the criteria should be determined by the "competent person" (as defined in existing § 1926.32(f)) and "should be the responsibility of each contractor on a project by project basis." Charles Greene (Ex. 43-47) stated that OSHA should require inspection of wire rope before each use. The Agency believes that compliance with the general requirements in final rule § 1926.451(f)(3), which provides that a competent person shall inspect scaffolds (including supporting structures and anchorage points) for visible defects prior to each work shift and after any occurrence that could affect the

scaffolds' structural integrity, will provide adequate assurance that unsafe scaffolds are not used. Accordingly, the Agency has not added additional specific criteria for inspection of repair bracket scaffolds to the final rule.

Reopening Issue 3 sought comment on the use of a wire rope placed at the platform level in lieu of an inner guardrail system on tank builders' scaffolds. The Steel Tank Institute (STI) (Ex. 43-5) stated:

One STI member uses a fabricated hook with an eyelet for attaching a safety lanyard and harness. The hook is hooked over the top plate of steel on the tank being erected. This system allows a high degree of mobility for workers since the hook can slide horizontally along the steel plate, and results in 100% fall protection. If such a system is used, the space between the scaffold planks and the tank shell should not be an issue.

OSHA believes that, in general, the use of guardrail systems or personal fall arrest systems would provide more effective protection than the system described by the STI. The Agency also believes, however, that the method described by this commenter to use personal fall arrest systems could be used in many cases to provide protection equivalent to the wire rope guardrail described in Issue 3.

Reopening Issue 5 asked what criteria, if any, should be set for brackets used with repair bracket scaffolds. CCI (Ex. 43-1) stated that there was "no need" to set such criteria. In addition, the NACHS (Ex. 43-21) responded "[n]o criteria should be set by OSHA that may restrict material and system improvements that are in constant change due to modern technology." The Agency agrees that it is important to encourage development of improved systems and materials. Furthermore, OSHA believes that compliance with the requirements in final rule §§ 1926.451 (a), (b) and (c), will ensure that brackets used on repair bracket scaffolds provide adequate protection for employees. Accordingly, the Agency has not added specific criteria for brackets to the final rule.

Reopening Issue 9 asked whether the safety factor for wire rope used with repair bracket scaffolds should be 4:1, as recommended by the NACHS (Ex. 34-33), or 6:1, as provided in proposed § 1926.451 (a) and in Item (d). OSHA noted that a 4:1 safety factor might be inadequate because the use of wire rope clips reduces the strength of the rope. The NACHS (Ex. 43-21) stated "[t]he Committee unanimously recommends a safety factor of 4:1 be satisfied." OSHA believes that the strength of wire ropes used with repair bracket scaffolds is just as important as the strength of ropes

used with other scaffolds. Therefore, the Agency has determined that the 6:1 safety factor which OSHA has set as a general requirement for wire ropes (final rule § 1926.451 (a)) is also appropriate for wire ropes used with repair brackets.

Reopening Issue 11 asked if OSHA should specify that each platform unit on a chimney bracket scaffold shall extend at least 12 inches over its supports, as recommended by NACHS (Ex. 34-33) and provided by Item (f), or extend at least 6 inches (unless cleated or otherwise restrained) as provided by proposed § 1926.451 (b). CCI (Ex. 43-1) stated that platform units should extend out at least 12 inches. The NACHS (Ex. 43-21) stated that OSHA should require minimum extension of 6 inches unless cleated or otherwise restrained as provided by proposed § 1926.451 (b), but did not explain why it had changed its position. OSHA believes that compliance with the 6-inch requirement as set forth in final rule § 1926.451 (b)(4) will adequately protect employees working on repair bracket scaffolds.

Items (c) and (h) would have incorporated strength and guardrail requirements into paragraph (x). These provisions are not needed because the general requirements in final rule § 1926.451 (a) and (g) adequately address scaffold capacity and fall protection.

Item (g) provided that the span of platform units from bracket to bracket shall not exceed 5 feet on the outside of the brackets. As noted above, Monsanto (Ex. 43-45) supported the inclusion of this provision in the final rule. The Agency notes that while span is a factor, the issue is already addressed by the general requirements for minimum and maximum overhang (final rule § 1926.451 (b)(4) and (5)), and the capacity requirements of § 1926.451 (a). There is thus no need to add this requirement to the final rule.

#### Paragraph (y) Stilts

Final rule paragraph (y) provides requirements for the use of stilts. Neither OSHA's existing scaffold standard (subpart L) nor the proposed rule directly addressed the use of stilts. NPRM Issue 20 asked if OSHA should prohibit or regulate the use of stilts. In particular, the Agency requested suggestions as to the appropriate construction and use of stilts, fall protection for employees wearing stilts, floor conditions in areas where stilts are being used, and other necessary considerations.

The SSFI (Ex. 2-367) stated that they "would support OSHA's prohibition on using stilts while undertaking work on scaffolds" as this "would be considered

unsafe." Another commenter (Ex. 2-29) stated, "stilts are not recommended for construction conditions. Unevel working surfaces, debris, etc. are particular problems when using stilts."

On the other hand, a commenter (Ex. 2-13) stated, "OSHA should not prohibit the use of stilts. They have been used safely for many years. They should never be used near any unprotected opening." The SIA (Exs. 2-368, 5a-16) agreed that the Agency should promulgate a rule permitting the use of stilts but should spell out "some safety rules, particularly when their use places the worker at heights above the standard guardrail protection." Many commenters on Issue 20 used a specific height (length) of no more than 40 inches as a cut off point above which they considered the use of stilts to be unsafe (Exs. 2-47, 2-61, 2-63, 2-67, 2-78, 2-156, and 2-304).

Over 460 other commenters expressed the view that Issue 20 was the first step towards a prohibition on the use of stilts. Those comments stated that prohibiting the use of stilts would cause employees to sustain injuries from over-reaching and falling from ladders, stools, platforms, homemade benches, boards, inverted buckets and other devices they would otherwise use to elevate themselves when doing painting, finishing or ceiling work. In particular, one commenter (Ex. 2-99) stated

Based on our experiences over these many years, we have found stilts to be a very safe and effective means to perform work in a timely and efficient and safe manner. Whenever stilts are used on a project, we have found that general housekeeping improves. There is much less debris found even on a short term basis than there would be with conventional scaffolding. We are able to use stilts to reach areas where conventional scaffolding and even ladders would be unsafe due to jobsite conditions. We do not let just any employee work on stilts. Our safety record attests to that. During the twenty (20) years we have used stilts, we have only had two (2) accidents involving the stilts—and both of these accidents were by the same employee.

Most of the commenters stressed the need for proper training for employees who use stilts (Exs. 2-6, 2-301, 2-379, and 2-406B). Most of the comments also indicated that some safety provisions, such as debris control, are needed if stilts are to be used.

Based on the concerns expressed by commenters, Issue L-4 of the hearing notice (53 FR 2048, January 26, 1988) set out four provisions that OSHA was considering for inclusion in the final rule for subpart L and solicited public input. Final rule §§ 1926.452(y)(1) and (2) address the use of stilts on large area

scaffolds, and §§ 1926.452 (y)(3) and (4) provide criteria for the use of stilts in general. These are based on the first through fourth provisions, respectively, raised in Hearing Notice Issue L-4.

The Association of the Wall and Ceiling Industries International testified (Tr. 3/22/88, p. 86, Ex. 5a-14) in favor of the proposed provisions. The SIA testified that stilt use was widespread and that stilts were considered a useful tool by the ceiling and wall industries (Tr. 3/22/88, pp. 157-158). The SIA testimony supported three provisions that OSHA is adopting, but did not express an opinion on the fourth provision (final paragraph (y)(2)).

Paragraph (y)(1) requires that employees not wear stilts on scaffolds except when the employees are on large area scaffolds. This paragraph is effectively identical to the language in the first provision raised for consideration in Issue L-4.

Paragraph (y)(2) provides, when employees wearing stilts are on large area scaffolds where guardrail systems are being used, that the dimensions of the guardrail system shall be increased to offset the height of the stilts. This paragraph corresponds to the language in the second provision raised for consideration in Issue L-4.

The SIA (Ex. 2-368) commented that a standard providing for the use of stilts on scaffolds should address guardrail height on scaffolds where stilts are being used.

Paragraph (y)(3) of the final rule provides that all surfaces on which stilts are used shall be flat and free of pits, holes and obstructions, such as debris, as well as all other tripping and falling hazards. This paragraph is identical to the language in the third provision raised for consideration in Issue L-4.

Many commenters noted the importance of removing potential tripping hazards where stilts are used (Exs. 2-54, 2-71, 2-99, 2-149, 2-166, 2-205, 2-219, 2-256, 2-272, 2-283, 2-295, 2-307, and 2-324). For example, a commenter (Ex. 2-54) stated:

It would seem those that would have the opportunity to use stilts the most would be stepping into a lot of loose debris that has fallen and quite vulnerable to injury from slipping and falling.

Paragraph (y)(4) of the final rule provides that stilts shall be properly maintained and that any alterations of the original equipment must be approved by the manufacturer. This paragraph is identical to the language in the fourth provision raised for consideration in Issue L-4.

Several commenters who responded to Issue 20 addressed the condition of

stilts. Those commenters (Exs. 2-59, 2-62, 2-71, 2-72, 2-108, 2-211, 2-219, 2-237, 2-243, 2-301, 2-304, 2-304, 2-313, 2-324, 2-379, 2-406B, and 2-409), generally, indicated that requirements for proper maintenance and inspection of stilt equipment, including straps and fittings, were needed. A number of manufacturers, contractors, and workers who use stilts also expressed strong approval for the use of manufactured stilts (as opposed to the use of job-made stilts) (Exs. 2-47, 2-127, 2-154, 2-257, 2-304-25, and 2-411A). The Agency has no information which indicates that job-made stilts pose a greater hazard than manufactured stilts, and therefore is not covering them differently under this paragraph. OSHA will monitor work experience under this provision to determine if it is appropriate to treat manufactured and job-built stilts differently.

#### *Section 1926.453 Aerial Lifts*

OSHA proposed to delete existing § 1926.451(f), *Elevating and rotating work platforms*, because the Agency believed that the existing provision was redundant with existing § 1926.556, *Aerial lifts*, which is in subpart N, Cranes, Derricks, Hoists, Elevators and Conveyors, of the Construction Standards. Existing § 1926.451(f) provides only that employers comply with ANSI A92.2-1969, Vehicle Mounted Elevating and Rotating Work Platforms. This requirement is also found in § 1926.556. Section 1926.556, in turn, sets some specific requirements for specified lift operations, but primarily references ANSI A92.2-1969.

The SIA (Ex. 2-368) objected to the proposed deletion, stating that equipment which falls under the definition of "scaffold" should be addressed by subpart L. ANSI A92.2-1969 classifies elevating and rotating work platforms as "scaffolds."

Based on consideration of the comment, OSHA believes that the retention of existing § 1926.451(f) would not be appropriate. However, the Agency agrees with the commenter that this type of equipment is a scaffold and that it should be addressed by subpart L. In order to facilitate the efforts of construction employers to safeguard employees who use elevating and rotating work platforms, the Agency has decided to move the requirements of § 1926.556 to a new § 1926.453, *Aerial lifts*, in subpart L. The introductory text to this section indicates that § 1926.453 applies only to ANSI A92.2 type equipment (vehicle mounted elevating and rotating work platforms), and further notes that the requirements of

§ 1926.451 and § 1926.452 do not apply to this type of equipment.

In addition, OSHA recognizes that the A92 Committee has updated A92.2-1969 and has adopted other A92 standards which address technological advances and evolving safe industry practices regarding elevating and rotating work platforms. The Agency has determined that compliance with the pertinent A92 standards adopted by ANSI since 1969 will provide employee safety at least equivalent to that attained through compliance with ANSI A92.2-1969. Accordingly, OSHA is providing a list of post-1969 ANSI A92 standards which are presently available, and is placing this list in a new non-mandatory Appendix C to this standard (subpart L). This non-mandatory appendix can be updated as necessary to include future revisions of the A92 standards or other relevant information.

Paragraph (a) addresses general requirements for aerial lifts, while paragraph (b) contains specific requirements for this equipment. Paragraph (b)(1) through (b)(5) specify requirements for ladder trucks and tower trucks, extensible and articulating boom platforms, electrical tests, bursting safety factors, and welding standards for aerial lifts, respectively.

#### *Section 1926.454 Training Requirements*

Section 1926.454 addresses training for employees working with scaffolds. The introductory text indicates clearly that this section both supplements and clarifies the training provisions in existing § 1926.21(b)(2). That standard, which applies to all construction work, requires employers to "instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." While that language clearly articulates the employer's general duty to provide training, OSHA believes it is appropriate to provide more specific direction regarding the training necessary for employees who work on scaffolds. Accordingly, § 1926.454 sets certain criteria allowing employers to tailor training to fit their workplace circumstances.

The introductory text of proposed § 1926.460 indicated that OSHA would cite employers for violations of the added training requirements in this section only when a citation was issued concurrently under the provisions of proposed §§ 1926.450, 1926.451 or 1926.452. However, it is clear to OSHA that this approach is not appropriate and does not provide adequate

employee protection, because the training of an employee does not necessarily ensure that an employee will follow the substantive safety provisions of the standard in every case.

OSHA's enforcement of the standard's training requirement does not depend on the extent to which an employer is fulfilling other compliance obligations under subpart L. In this regard, the scaffold standard is like any other OSHA standard that provides for both hazard prevention and employee training. The employer has separate duties to provide protection and to train employees, and may be cited for violating either or both types of requirements.

Paragraph (a) of the final rule sets training requirements for employers who have employees working on scaffolds. The introductory text requires employers to ensure that each employee whose employment involves being on a scaffold is trained to recognize the hazards associated with the type of scaffold being used and to understand the procedures which must be followed to control or minimize those hazards.

Proposed paragraph (a) required that all employees using scaffolds to perform a job task be instructed in the proper construction, use, placement and care of the scaffolds they are using, and in the applicable provisions of this subpart. OSHA has determined that the proposed provision should be revised to provide more specific direction regarding how employees working on scaffolds are to be trained. In addition, the Agency recognizes that it is appropriate to distinguish between the training needed by employees erecting and dismantling scaffolds and the training needed by employees who are on scaffolds in the course of their work. Accordingly, final rule paragraph (a) addresses employees who are working on scaffolds and final rule paragraph (b) addresses employees who are erecting and dismantling scaffolds. OSHA anticipates that some employees, such as those who use adjustable suspension scaffolds, will need training that complies with both paragraph (a) and paragraph (b).

The SIA and the Duke Power Company (Exs. 2-368 and 2-465) commented that employees who use scaffolds do not need to know how to construct, place, and care for these scaffolds. The SIA (Ex. 2-368) stated "Does every single worker on the job need to know how the scaffold is constructed, or how it was placed, or how it is to be cared for? This should be the responsibility of some 'competent' person, but not everyone on the scaffold." In addition, Duke Power (Ex. 2-465) noted "the majority

of scaffolds used are not constructed by the employees using them." As noted above, OSHA agrees with these concerns and final rule § 1926.454 reflects this thinking.

The introductory language of final rule paragraph (a) also requires employers to ensure that each affected employee has been trained by a person who is qualified in the pertinent subject matters. The requirement for training by a qualified person has been added to the final rule to ensure that the training is adequate. The ACCSH (Tr. 6/9/87, p. 266) recommended that OSHA require the involvement of a competent person in the program to provide appropriate assurance that employees will be adequately trained. However, the Agency has decided that a qualified person would be more appropriate because it is the knowledge, skill or experience of the trainer, not the trainers authority, which determines the adequacy of the training provided. Limiting the delivery of the required training only to a competent person would prevent employers from taking advantage of outside sources of training, such as scaffold manufacturers and suppliers, that regularly provide these types of services to clients.

Paragraphs (a)(1) through (a)(5) address five areas in which training must be provided, as applicable. Final rule paragraph (a)(1) requires that affected employees be trained in the nature of any electrical hazards, fall hazards and falling object hazards in the work area. Many employees have been killed or seriously injured because they were unaware of workplace hazards or did not understand the consequences of exposure to those hazards. This provision clearly indicates the hazards (i.e., electrocution, falls and falling objects) regarding which training must be provided. This paragraph elaborates on the requirements of existing § 1926.21(b)(2), which addresses training in the general recognition and avoidance of hazards.

Final rule paragraph (a)(2) requires that affected employees be trained in the correct procedures for protection from electrical hazards and for erecting, maintaining, and disassembling the required fall protection systems and falling object protection systems. Employees who are on scaffolds while working need to know how protective systems function, so that they know how to install, maintain or remove these systems, as necessary. For example, where a scaffold has been erected without the protective measures necessary for work to be performed on or from the scaffold, the employees subsequently coming onto the scaffold

would need to install them. Even where the scaffold erectors have installed the required protection for affected employees, the employees working on the scaffold need to know when and how to maintain that protection, so that a hazardous situation does not develop during scaffold use. Proposed paragraph (a) addressed this subject only in general terms.

The ANSI Z359 Committee stated (Ex. 2-57)

"[P]ersons who work on scaffolds should be required to undergo *fall protection* training. This is not specified in sufficient detail in 1926.460. The content, specificity and training environment for a fall protection training program should perhaps be considered as the subject of a national standard." OSHA agrees with this comment and has revised the proposed training provision accordingly.

Paragraph (a)(3) requires that employees be trained in the proper use of the scaffold and in the proper handling of materials on the scaffold. This paragraph is effectively identical to the corresponding provision of proposed paragraph (a). The language regarding the proper handling of materials has been added to facilitate compliance with the requirements for falling object protection.

Paragraph (a)(4) requires that employees be trained in the maximum intended load and the load-carrying capacities of the scaffolds used. This language is effectively identical with the corresponding language of proposed paragraph (a).

Paragraph (a)(5) requires that employees be trained in the pertinent requirements of subpart L. This provision is effectively identical to the corresponding language in proposed paragraph (a).

Paragraph (b) of the final rule addresses training for employees assembling, maintaining or dismantling scaffolds. The introductory language of paragraph (b) requires that the employer have each employee who erects, disassembles, moves, operates, repairs, maintains, or inspects a scaffold trained by a competent person so that the employee can recognize any hazards related to such work duties. This provision is effectively identical to the language in proposed paragraph (a). As noted above, final rule paragraph (b) is designed to differentiate clearly between the training needed by employees erecting and dismantling scaffolds and the training needed by employees who are on scaffolds in the course of their work. In addition, this provision corresponds, in part, to the language in proposed paragraph (b), which required that employees repairing scaffolds be

competent individuals "trained and familiar with the design criteria, intended use, and the proper procedures for repairing the defective component(s)."

The introductory language of final paragraph (b) requires the employer to ensure that each affected employee has been trained by a competent person in four areas, as applicable. As discussed above in relation to final rule § 1926.454(a), OSHA has added this requirement in response to a recommendation from the ACCSH (Tr. 266, 2/9/87).

Paragraph (b)(1) requires that affected employees be trained in the nature of scaffold hazards. This provision effectively restates the existing § 1926.21(b)(2) requirement that employees be instructed in the recognition and avoidance of unsafe conditions.

Paragraph (b)(2) requires that affected employees be trained in the correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question. This language, which is consistent with the corresponding language in proposed paragraphs (a) and (b), indicates clearly that training must address the particular type(s) of scaffold with which each affected employee will be working. Training provided to an employee to construct, repair or dismantle one type of scaffold will not necessarily enable that employee to repair another type.

Paragraph (b)(3) requires that affected employees be trained in the design criteria, maximum load-carrying capacity, and intended use of the scaffold. This provision is consistent with the corresponding language in final rule paragraph (a)(4).

Final rule paragraph (b)(4) requires that affected employees be trained in the pertinent requirements of subpart L. This provision, like final rule paragraph (a)(5), is effectively identical to the corresponding language in proposed paragraph (a).

Non-mandatory Appendix D lists various training topics that may be important for the employers and employees erecting or dismantling scaffolds. The list is not all-inclusive, and OSHA is providing it solely as informational guidance. The employer may need to address topics or situations not mentioned in the Appendix which are specific to the employer's particular circumstances.

Proposed paragraph (c), which addressed training specifically for employees who operate suspended scaffolds, has been deleted from the final rule, because the Agency has

determined that training for these employees is adequately covered by the requirements in paragraphs (a), (b) and (c) of the final rule.

Final paragraph (c) requires the employer to retrain any employee when the employer has reason to believe that the employee does not have the understanding and skill required by paragraph (a) or (b) of this section. Employees must be retrained, as necessary, to restore the requisite scaffold-related proficiency. Circumstances where the provision requires retraining include, but are not limited to, the following situations: first, whenever there is a change at the worksite that presents a hazard about which the employee has not been trained (paragraph (c)(1)(i)); second, where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which the employee has not been trained (paragraph (c)(1)(ii)); and, third, where inadequacies in an affected employee's work practices involving scaffolds indicate that the employee has not retained the requisite proficiency (paragraph (c)(1)(iii)). This provision simply clarifies the language of proposed § 1926.460(d), which stated that employees would receive training and retraining as necessary. OSHA notes that this provision is essentially identical to the corresponding retraining requirements in the Construction Industry fall protection standard (§ 1926.503(d)) and the General Industry standards for permit-required confined spaces (§ 1910.146(g)(2)) and personal protective equipment (§ 1910.132(f)(3)).

NPRM Issue 15 solicited comments regarding employee training and retraining on scaffold use. In particular, OSHA asked for data on the costs and effectiveness of training requirements in reducing the risk of injuries or fatalities, and whether more or less specific requirements were appropriate. Commenters were also asked to provide the Agency with information about currently available safety programs and their adequacy; the safety records of employees who have been trained; the scope and necessary elements of training programs; the relationship of the additional specific provisions in proposed § 1926.460 to the more general § 1926.21 requirements; the costs and benefits of these provisions; and possible recordkeeping burdens these provisions might involve.

The SIA (Ex. 2-368) stated: "[T]he SIA devotes a considerable portion of its budget to promotion of safety and training through audio-visual programs and training courses for the safe use of scaffolds. We believe that training will

reduce accidents and would like to see some additional requirements in the scaffold standards." However, the SIA expressed concern that employers would have to "establish and maintain extensive records on each employee" because the rule would expose them to "increased liability from an insurance standpoint" and to OSHA citations. The SIA also indicated that training would not be able to cover all foreseeable equipment use, and that an employer who assumed that training was all-encompassing would be compromising the safety of its employees. Furthermore, the SIA stated that the proposed training requirements would pose practical problems for employers because of employee mobility and related staffing concerns.

Based on the above-discussed concerns, the SIA made the following recommendations regarding 'additional' training requirements:

As a minimum, employers should be required to furnish to employees working on scaffolds printed safety rules (Codes of Safe Practice) for the particular type scaffold they are using. The employee should be required to read the rules in the presence of the employer or his agent (a competent person) and be questioned as to whether the employee understands the rules.

Due to the extreme hazard associated with the use of suspended scaffolds, a written training program should be required. The program should include formal certification by the employer upon completion of the program by the employee. Persons without such training should not be allowed to work on suspended scaffolds.

OSHA notes that the training requirements in both the final rule and the proposed rule have been framed in performance-oriented language. This approach allows employers the flexibility to establish programs which reconcile the need for training with the circumstances at particular workplaces.

The AGC (Exs. 2-20, 2-55, and 2-390) contended that any additional training requirements would be redundant and economically infeasible, given the construction industry's high employee turnover. The GLFEA and ABC (Exs. 2-22 and 2-69) commented that training requirements would "impose practical problems" due to workforce mobility. In addition, the GLFEA, ABC and the Builders' Association of Missouri (Ex. 2-50) stated that the requirements of § 1926.21 already adequately address training. The GLFEA added that "other constraints \* \* \* such as insurance costs and workers compensation rates, impose a requirement on \* \* \* employers to train their employees and \* \* \* follow safety requirements."

OSHA recognizes that employee turnover can increase an employer's training responsibilities. The Agency notes, however, that the existing standard already requires construction employers to provide training for their employees, notwithstanding employee turnover or other day-to-day changes in the employer's workforce. Furthermore, the Agency believes that § 1926.454, insofar as it elaborates on the training requirements of existing § 1926.21(b)(2), simply codifies good industry practice and provides useful direction for how training programs can "do it right." Accordingly, OSHA has determined, based on the rulemaking record, that any additional responsibilities imposed by final rule § 1926.454 are reasonable and necessary to protect employees from serious hazards.

Furthermore, employers need not retrain employees who are trained by a previous employer or were trained prior to the effective date of the standard, as long as the employee demonstrates the proficiency required by the pertinent provisions of this section. This approach is consistent with that taken in part 1910, subpart I (Personal protective equipment) and part 1926, subpart M (Fall protection).

A manufacturer of suspended scaffolds, Sky Climber, recommended (Ex. 2-64) requiring that all riggers and operators of suspension scaffold equipment be formally trained and certified and carry a certificate or license to evidence their completion of training. That commenter provided the following to explain their position:

Improper rigging and operator error were the second and third major cause and cost of our product incidents. We believe that training of operators and riggers will substantially reduce the frequency and cost of incidents. In fact, of the over 1500 persons who complete our Training Program in operation, maintenance and rigging since 1980, to our knowledge, not one has been involved in a suspension scaffold incident.

Sky Climber added that this training should be mandatory, and since "[t]he primary responsibility for training rests with the employer \* \* \* he or some other qualified party should provide the required training."

Seedorff Masonry Inc. (Ex. 2-407) commented

We have always used our foreman as the instructor and this has worked out very well. We can agree that there could be an additional rule on this point, however additional paperwork would not be feasible. We could find our superintendents only doing paperwork without enough time to oversee job sites and develop good safety on the job sites.

The SSFI (Ex. 2-367) commented in favor of proposed § 1926.460, stating as follows:

Members of the SSFI are in full support of the training requirements for the contractor provided within the OSHA revision. If followed, the training requirements would reduce the number of accidents on construction projects. There currently exist many Institute Safety Rules and Recommendations as well as many recommendations developed by the manufacturers of the equipment. As a minimum, those requirements can be used and, if followed, should dramatically reduce the accidents of construction employees. These construction employees should be trained by the contractor at the construction site prior to their actual start of work, and should not be trained on-the-job as they are working.

Alum-A-Pole Corporation, a manufacturer of pumpjack scaffolds, stated (Ex. 2-31) "[o]n-the-job training is the mode in which pumpjack users gain proficiency in proper installation. On that basis, sequential pictorial instructions with minimal verbiage \* \* \* if adhered to, would virtually eliminate accidents."

Two commenters (Exs. 2-2 and 2-13) expressed the view that cost should not be an issue in matters of safety. In addition, one of these commenters (Ex. 2-13) found from his own experience that both employers and employees should be trained and retrained.

Another commenter (Ex. 2-54) supported training and retraining and provided details of the commenter's training program. The comment touched on the value of discussions, involving both workers and apprentices, regarding the proper way to use equipment. In particular, the commenter indicated that employees are more productive when they are confident that they have the right equipment and know how to use it.

In addition, discussion by the ACCSH on Issue 15 noted that training is cost-effective and beneficial for both employees and employers (Tr. 6/9/87, pp. 130-136). One member stated: "I've heard several employers state that these training programs save 4 to 5 percent of the gross cost of the project, which oftentimes is more than double the amount that they got the bid by in the first place.

They might have gotten the bid by less than 2 percent, but they save 5 percent with the proper training program."

Issue L-1 of the hearing notice (53 FR 2049) requested testimony and related information on any current training programs which issue certificates or licenses to indicate that employees have been adequately trained to erect, use or

dismantle specific types of scaffolds. The Agency indicated that it was considering adding a requirement for verification of compliance through a written certification. In particular, OSHA sought comment on the following language:

§ 1926.461 Certification. (a) The employer shall certify that all employees who are erecting, maintaining and dismantling scaffolds, have been adequately trained in the appropriate precautions and safe practices before they are allowed to perform any such scaffold work.

(b) The employer shall certify that the employee has been trained by preparing a certification record which includes the identity of the person trained, the signature of the employer or the person who conducted the training, and the date the training or retraining was completed. The certification record shall be prepared at the completion of training and shall be maintained on file for the duration of the employee's employment. The certification record shall be made available upon request to the Assistant Secretary for Occupational Safety and Health or designee.

Issue L-1 stated that the above language would not require the "collection of information," and would not, therefore, impose a paperwork burden on the employer under the terms of the Paperwork Reduction Act (44 U.S.C. Chapter 35) and the implementing regulations (5 CFR 1320.7(j)).

The Association of Wall and Ceiling Industries (AWCI) (Ex. 9; Tr. 3/22/88, p. 83-84) testified that certifying somebody as adequately trained "opens up a potential of increased liability so what I'm asking OSHA to do for us is to provide some definition of 'adequately trained.' Whether this is a model training program or perhaps a listing of the subjects to be covered under this adequacy of training and also some indication of who's going to do the training." AWCI also asked whether any employee who works on a scaffold must be trained in its proper construction, placement, and care.

The AWCI (Ex. 9; Tr. 3/22/88, p. 84-85) also noted that, given the constant exchange of employees in the construction industry, "portability" of training was a point of concern. They questioned, for example, whether a contractor who has trained employees on a project and rehires them a month and half later would have to retrain them. Similarly, in response to a question regarding the type of training scaffold erectors typically receive, AWCI stated that:

\* \* \* most of it is on-the-job training that's handed down to new employees as they come aboard the company or is brought by the employees from the previous



company. The training programs could have been derived from the manufacturer of the scaffolding equipment, could be derived from the in-house training program that the contractor has and some of these contractors have extensive programs in place on-site. It could also be derived from the scaffold industry association \* \* \* programs that they have in place \* \* \* (Ex. 9; Tr. 3/22/88, pp. 91-92.)

The AWCI further testified (Ex. 9; Tr. 3/22/88, p. 90) that EPA's asbestos abatement certification program provided "[t]he ground floor of employee protection." They pointed out that the program requires 3 days of classroom training, including some "hands-on," and includes a listing of all points the program is to cover. In addition, the AWCI testified that "[the program] gives employees an added margin of safety by making them aware of the hostile environment they're going to be in, and added that a foreman, contractor, or supervisor must go for an additional day of training and that they receive instruction regarding insurance programs and legal ramifications." When asked to comment on EPA's certification program versus that which might be required for scaffold erection, the AWCI replied (Tr. 3/22/88, p. 91) that OSHA should specify the points "to be covered in the training program and the credentials of the trainer" if OSHA is going to require a certification program.

In addition, Bristol Steel (Ex. 13; Tr. 3/23/88, pp. 2-147 and 2-148) stated that certification is a weighty responsibility with significant legal implications. Bristol Steel also contended that any legal liability arising from a certification program should be the burden of a trade organization (Tr. 3/23/88, pp. 2-181-182).

Bristol Steel also stated (Ex. 13) that the proposed certification requirement would add a paperwork burden to employers. The commenter added that before requiring certification, OSHA should show that such a requirement could be "implemented and universally enforced and will cause a material reduction in scaffold accidents."

The SIA testified (Ex. 10; Tr. 3/22/88 p. 151) that a certification requirement would expose employers to "tremendous liability to civil and even criminal negligence suits in addition to those penalties prescribed under OSHA." The SIA added that they "worked closely with Cal-OSHA in developing a certification program in 1981, which had to be abandoned because the SIA and its members could not assume the liability created by Cal-OSHA's insistence that we 'certify the competency of the worker'."

The Montague-Betts Company, Inc. and SEAVAC testified that training and certification of workers using scaffolds were appropriate and useful, but that "a lot of definition of scope and what certification consists of is necessary before \* \* \* people can take a final position as to the complete merits and workings of such a proposal" (Tr. 3/23/88, pp. 2-198). Montague-Betts (Ex. 5a-5) stated that certification of employees using scaffolds is appropriate. On the other hand, SEAVAC (Ex. 5a-17) stated that certification is appropriate for employees who erect or dismantle scaffolds but not for other employees.

The SSFI (Ex. 5a-19) stated that training for individuals who use and erect scaffolds had been a subject of great debate within the institute and stated that their members were "very supportive of a [s]tandard that would require training for the use, erection, and dismantling of scaffolds." They recommended the following elements for training:

- Two categories of training: one for scaffold users and one for scaffold erectors and dismantlers;
- Issuing employee "qualification cards" that could be presented to employers, and which would certify completion of a sanctioned training program;
- Nationally uniform training programs;
- A national program requiring certification to balance economic consideration among contractors;
- A gradual transition for the implementation of such a training program;
- Permitting vocational trades, technical, or other qualified teaching organizations or contractors to provide this type of training service;
- Not allowing training and certification to be substituted for existing safety requirements, such as those provided by the equipment manufacturer.

Some commenters opposed the certification language in Issue L-1. One (Ex. 2-593) indicated that the training requirements in § 1926.21 and proposed § 1926.460 were sufficient. Another (Ex. 2-594) called the section regarding certification "too restrictive." Monsanto (Ex. 2-595) disagreed with certification of training and retention of the certification in a file. Monsanto indicated that it had not had problems with scaffold erection, maintenance, and dismantling that would warrant certification of training. They added that the proposed retention requirement for certification information documents would "present an unwarranted paperwork burden on the employer."

The Edison Electric Institute (Ex. 5a-6) responded that a written certification

was unnecessary and would add a significant paperwork burden for employers. EEI added that regular training would assure that employees know how to safely "handle scaffolds." EEI also stated that the work involved in these operations is not so sophisticated that routine training should be considered inadequate.

OSHA has determined, based on its review of the record, that a written certification would impose an additional burden on employers without a demonstrable increase in worker safety. OSHA can determine if workers have been adequately trained by talking with the employees and observing their work habits. In addition, the Paperwork Reduction Act, as recently revised, classifies certification as a type of information burden for which OSHA must present a justification. Given the Agency's conclusion that the necessary information can be obtained without referring to documents, such a burden would not be justified. Therefore, the final rule will not contain a requirement for training certification.

#### *Non-Mandatory Appendix A to Subpart L—Scaffold Specifications*

This appendix is provided as a guide to assist employers in complying with the requirements of § 1926.451. This appendix is non-mandatory. As stated above in the discussion of paragraph 1926.451(a), scaffolds built in accordance with this Appendix A will be considered to meet the intent of this revised subpart L. A full discussion of the contents of this Appendix A, and any comments on the proposed Appendix A, is found above, in the discussion of § 1926.451(a).

#### *Non-Mandatory Appendix B to Subpart L—Criteria for Determining the Feasibility and Safety of Providing Safe Access and Fall Protection for Scaffold Erectors and Dismantlers*

This space is being reserved for publication of informational guidance at a later date.

#### *Non-Mandatory Appendix C to Subpart L—List of National Consensus Standards*

This Appendix is provided to serve as a guide to employers required to provide appropriate employee protection under § 1926.453, Aerial Lifts. This Appendix reflects the proliferation of equipment-specific ANSI A92 standards since the adoption of ANSI A92.2-1969.



*Non-Mandatory Appendix D to Subpart L—List of Training Topics for Scaffold Erectors and Dismantlers*

OSHA has developed this Appendix to assist employers in identifying appropriate topics for training scaffold erectors and dismantlers.

*Non-Mandatory Appendix E to Subpart L—Drawings and Illustrations*

This Appendix provides drawings of particular types of scaffolds and scaffold components, and graphic illustrations of bracing patterns and tie spacing patterns. It is intended to provide visual guidance to assist the user in complying with the requirements of this standard.

#### IV. Economic Assessment and Regulatory Flexibility Analysis

##### *Introduction*

Executive Order (EO) 12866 requires regulatory agencies to conduct an economic analysis for rules that meet certain criteria. The most frequently used criterion under EO 12866 is that the rule will impose annual costs on the economy of \$100 million or more. OSHA's final standard for scaffolds in construction does not meet this criterion, or any of the other criteria specified by EO 12866, and therefore does not require an economic analysis. Nevertheless, OSHA has decided to conduct such an analysis to provide the regulated community with as much information about the rule as possible. The Regulatory Flexibility Act of 1980, as amended in 1996, requires OSHA to determine whether the Agency's regulatory actions will have a significant impact on a substantial number of small entities. Making this determination requires OSHA to perform a screening analysis to identify any such impacts. Consistent with these requirements, OSHA has prepared this economic analysis and regulatory flexibility screening analysis of the final rule for scaffolds in construction. The final rule being published today will replace the outdated consensus standard addressing scaffolds in construction that was adopted by OSHA in 1971 and has remained largely unchanged since then.

This analysis includes a description of the industries affected by the regulation, an evaluation of the risks addressed, an assessment of the benefits attributable to the final standard, a determination of the technological feasibility of the new requirements, an estimate of the costs of compliance with the standard, a determination of the economic feasibility of compliance with the standard, and an analysis of the economic and other impacts associated with this rulemaking, including those

on small businesses. The following is a summary of this analysis, which is available from OSHA's docket office.

##### *The Final Standard for Scaffolds in Construction*

This final standard for scaffolds in the construction industry makes many changes to the consensus standard adopted by OSHA in 1971 and codified at 29 CFR 1926.450 to 1926.453 (Subpart L of OSHA's construction industry standards). Appendix A of the Final Economic Analysis compares, on a provision-by-provision basis, the final standard with the standard that has been on the books since 1971. In this economic analysis, the standard being published today is referred to as the final standard, while the standard it replaces is termed the "existing" standard.

One of the important distinctions between the two standards is the clarity and simplicity of the final standard, which is written in language that people in the construction industry use to describe scaffolds and their components. Technical terms required to convey information accurately and unambiguously are defined clearly in paragraph (b) of final rule § 1926.450. The final rule also updates the regulatory text to reflect changes in technology that have occurred in the quarter century since the existing standard was written. These changes will permit scaffold manufacturers and users to benefit from technological change and give them additional flexibility in using up-to-date equipment. The final standard also clarifies and resolves issues of terminology or areas of confusion that have been identified by scaffold users over the years. In the past, OSHA has addressed implementation problems of this sort in letters of interpretation or compliance memoranda or directives; the final standard corrects and revises the provisions that gave rise to these interpretations. Finally, the final standard adds protection for employees using scaffolds. The principal areas in the new standard that have been strengthened are employee training, protection from electrical hazards, and procedures for employees engaged in the erection and dismantling of scaffolds. These requirements reflect OSHA's long experience in accident investigation in the construction industry, as well as an extensive analysis of the leading causes of scaffold-related fatalities and injuries.

##### *Affected Industries*

The requirements of the final standard apply to all establishments in the

construction industry. As classified by the 1987 Standard Industrial Classification (SIC) manual, the industry can be divided into three broad types of activities: building construction general contractors (SIC 15), heavy construction general and special trade contractors (SIC 16), and construction by other special trade contractors (SIC 17).

There are 572,850 establishments in the construction sector employing approximately 4.7 million employees. Small establishments with one to nine employees, which represent 82 percent (or 469,349) of establishments, collectively employ only 1.4 million employees (30 percent). The number of construction workers is estimated to be approximately 3.6 million. OSHA estimates that there are approximately 2.34 million construction workers (65 percent of all construction workers) who frequently work on scaffolds and who would be affected by the final standard for scaffolds.

##### *Evaluation of Risk and Potential Benefits*

Of the 510,500 injuries and illnesses reportedly occurring in the construction industry annually, an estimated 9,750 are related to scaffolds. Similarly, of the estimated 924 occupational fatalities occurring annually among construction employees, at least 79 fatalities are associated with work on scaffolds. OSHA estimates that the new requirements in the final rule will prevent 47 of these fatalities and 4,455 of these injuries annually; these numbers are above and beyond the fatalities and injuries that would be prevented if construction employers complied with OSHA's existing scaffold standard. OSHA estimates that the total value of the cost savings associated with this revised standard is \$90 million per year. This estimate of cost savings considers only those scaffold related injuries that involve lost workdays.

##### *Costs and Technological Feasibility*

The total estimated costs associated with the final standard amount to about \$12.62 million annually. The largest single cost (\$5.85 million) is associated with inspections of non-suspended scaffolds before use. The remaining costs are attributable to requirements for additional training for employees exposed to potential hazards involving work on scaffolds (\$5.30 million) and for fall protection for employees erecting and dismantling scaffolds<sup>1</sup> (\$1.47 million). Table ES-1 shows the annual costs of compliance associated with the final rule.

TABLE ES-1.—ANNUAL COSTS OF COMPLIANCE WITH THE FINAL RULE FOR SCAFFOLDS IN CONSTRUCTION

Provision	Annual cost
Training:	\$5,298,708
Training for Workers Who Use Scaffolds .....	3,014,949
Training for Scaffold Erectors, Dismantlers, Inspectors and Repairers .....	2,283,759
Fall Protection for Erectors and Dismantlers of Scaffolds <sup>1</sup> .....	1,466,431
Scaffold Inspection .....	5,851,823
Total .....	12,616,962

Source: US Department of Labor, OSHA, Office of Regulatory Analysis, 1996.

(1) This requirement has a one year delayed implementation date.

Because the requirements of the final standard can be met with existing equipment and methods, the standard is technologically feasible.

#### *Economic Impacts*

Compliance with the requirements of the final standard has been determined to be economically feasible and is not expected to produce significant adverse economic impacts on firms in the construction industry. The estimated compliance costs represent less than 0.002 percent of construction revenues. Given the minimal price increase necessary to cover the costs of the final standard, employers should be able to pass these compliance costs on their customers. However, even if all costs were absorbed by the affected firms (a highly unlikely scenario), the average reduction in profits would be only 0.04 percent.

#### *Regulatory Flexibility Screening Analysis*

Pursuant to the Regulatory Flexibility Act of 1980 as amended (5 U.S.C. 601 et seq.), OSHA has assessed the small-business impact of the final standard for scaffolds used in construction, and has certified based on that assessment and the underlying data, that the standard will not have a significant impact on a substantial number of small entities. The controlling consideration for a regulatory flexibility analysis is whether the standard would impose significant economic impacts on a substantial number of small entities. The significance of any economic impact is measured by the effect on profits, market share, and an entity's financial viability.

The small establishment size standards established by the U.S. Small Business Administration (SBA) for the

construction industry, which are based on establishment receipts, are \$17 million for establishments in SICs 15 and 16, and \$7 million for establishments in SIC 17. Of the 572,850 establishments affected by the revised standard, 493,637<sup>1</sup> establishments, or about 86 percent of all construction establishments, are considered small establishments as defined by the SBA.

OSHA assessed the potential economic impacts of the rule on all affected establishments and has concluded that the rule is economically feasible and will not impose a substantial burden on construction employers. As indicated above, firms would only have to increase the price charged for their services by, at most, 0.002 percent of the value of their sales in order to recover the money they expended on compliance. In the unlikely event that firms could not pass any of these costs to their customers and had to absorb all of the costs themselves (a highly unlikely scenario), the average reduction in profits caused by these costs would be only 0.04 percent. On average, the value of receipts for establishments in the construction industry is estimated to be \$1.12 million. Firms with sales in this range clearly fall within the SBA size standard.

To ensure that even the smallest firms in this industry would not be significantly impacted by the costs of compliance associated with the final standard, OSHA also examined the financial profile for small construction establishments with 9 or fewer employees at the four-digit SIC code level, which constitutes the overwhelming majority of firms in this industry. To examine the impact of the standard on the smallest and potentially most affected firms, OSHA made a series of extreme-case assumptions: that all employees in these establishments use scaffolds in the course of their work and that these establishments have not implemented any of the new work practices or procedures required by the final rule. In addition, OSHA assumed that two employees at each firm would require fall protection systems and training in the erection and dismantling of supported-scaffolds. Assuming a baseline turnover rate of 15 percent, and using the formulas presented in Chapter V of the Economic Analysis, such a small establishment, which represents an extreme-case impact situation, would

incur compliance costs of \$603<sup>2</sup> annually.

Table ES-2 presents the results of this extreme-case analysis. It shows estimated compliance costs and economic impacts relative to revenues and pre-tax income for small businesses by four-digit SIC code level. OSHA compared the baseline financial data for these firms with OSHA's estimate of the standard's annual compliance cost by computing compliance costs as a percentage of revenue. This approach (Table ES-2) reflects extreme case impacts because it assumes that employers have to recover the costs of achieving compliance by increasing their prices. Under this full cost pass-through scenario, the maximum average expected price increase required to recover the full costs of compliance with this standard would be extremely small, approximately 0.1 percent. The four-digit industry estimated to experience the highest potential price increase would be Painting and Paper Hanging (SIC 1721), where firms could have to increase prices by 0.18 percent. Again, since these impacts are based on extreme-case costs, they are likely to be overestimating.

Under the second scenario used to test the impacts of actions on markets—the no cost pass-through scenario—firms are assumed not to be able to pass any of their costs through to their customers in the form of price increases. If no costs can be passed on, firms would have to absorb these costs entirely from their profits (a highly unlikely scenario). Using this assumption, the average expected decline in profits for these very small firms would be only 1.44 percent. The largest potential impact of the standard would be anticipated in the Plastering, Drywall and Acoustical industry (SIC 1742), where firms could experience a decline in profits of 2.71 percent. Such impacts are not large enough to be significant because they mean, for example, that the profit rate for such a company would decline only from 5.0 percent to 4.9<sup>3</sup> percent. As noted, these figures are based on highly conservative assumptions and are therefore likely to overestimate standard's impact.

Because fixed costs, such as those for preparing training materials, are larger as a percentage of revenues the smaller the firm, the smallest firms will experience the greatest economic

<sup>1</sup> 144,671 establishments in SIC 15, 28,206 establishments in SIC 16 and 320,637 establishments in SIC 17.

<sup>2</sup> Annual 15 minute-training for workers who use scaffolds = \$11, annual training cost for erectors and dismantlers = \$130, annual cost of fall protection = \$106, and annual scaffold inspection cost = \$356.

<sup>3</sup>  $\$22,265 / \$445,303 = 5.0\%$ ,  $\$22,265 \times (100 - 2.71\%) / \$445,303 = 4.9\%$ .

impacts. If the smallest firms, with extreme-case costs, will experience no significant impact, it is reasonable to conclude that larger firms will not experience significant economic

impacts. Thus, because this standard will not have a significant impact either on the smallest establishments (those with 9 or fewer employees) or on the typical establishment in this industry,

OSHA certifies that this final standard will not have a significant economic impact on a substantial number of small entities, as defined by the SBA.

TABLE ES-2.—ECONOMIC IMPACTS OF THE FINAL SCAFFOLD STANDARD ON CONSTRUCTION BUSINESSES WITH 5 EMPLOYEES. BY 4-DIGIT SIC, USING WORST-CASE COMPLIANCE ASSUMPTIONS

SIC industry	Value of industry receipts per establishment [a]	Pre-tax income per establishment [b]	Compliance costs as a percent of revenues	Compliance costs as a percent of pre-tax income
15 Building Construction-General Contractors .....	\$1,039,353	\$56,692	0.06	1.06
1521 General Contractors-Single-Family Houses .....	824,664	61,225	.07	0.98
1522 General Contractors-Residential Buildings .....	989,058	73,430	.06	0.82
1531 Operative Builders .....	2,459,972	81,999	.02	0.73
1541 General Contractors-Industrial Buildings & Warehouses .....	1,159,689	52,713	.05	1.14
1542 General Contractors-Non-residential Buildings .....	1,278,174	61,972	.05	0.97
16 Heavy Construction Other than Building Construction .....	934,365	59,460	.06	1.01
1622 Bridge, Tunnel and Elevated Highway Construction .....	1,312,204	47,717	.05	1.26
1623 Water, Sewer, Pipeline and Communications .....	832,093	50,430	.07	1.19
1629 Heavy Construction, nec. ....	717,664	50,019	.08	1.20
17 Special Trade Contractors .....	471,876	32,888	.13	1.83
1711 Plumbing, Heating & Air Conditioning .....	520,496	31,545	.12	1.91
1721 Painting and Paper Hanging .....	331,775	30,664	.18	1.96
1731 Electrical Work .....	463,498	34,411	.13	1.75
1741 Masonry, Stone Setting .....	357,551	25,462	.17	2.37
1742 Plastering, Drywall, Acoustical .....	445,303	22,265	.14	2.71
1743 Terrazzo, Tile, Marble and Mosaic Work .....	404,702	28,820	.15	2.09
1751 Carpentry Work .....	414,681	32,672	.15	1.84
1752 Floor Laying and Other Floor Work, nec. ....	573,175	39,949	.11	1.51
1761 Roofing, Siding and Sheet Metal Work .....	470,902	30,680	.13	1.96
1771 Concrete Work .....	510,955	36,386	.12	1.66
1791 Structural Steel Erection .....	541,947	36,130	.11	1.67
1793 Glass and Glazing Work .....	555,960	32,852	.11	1.83
1796 Installation or Erection of Building Equipment, nec. ....	581,564	30,841	.10	1.95
1799 Special Trade Contractors, nec. ....	504,453	40,509	.12	1.49
Average .....	.....	.....	.10	1.44

Source: U.S. Department of Labor, OSHA, Office of Regulatory Analysis, 1996.

[a] Based on Small Business Administration, Office of Advocacy, Table 3: The Number of Firms, Establishments, Employment, Annual Payroll, and Estimated Receipts by Industry and Firm Size, 1993.

[b] Average revenue per establishment x mean profit rate for SIC (derived from Dun and Bradstreet Information Services, Industry Norms and Key Business Ratios 1994-95) x conversion formula based on the federal corporate tax schedule.

[c] Annual cost of compliance of 603 per establishment assumes that all workers (5) would require training in the initial year and that all new workers in subsequent years would require training. Two workers will be trained in dismantling and erecting procedures. Estimates also assume that fall protection will be required for erectors and dismantlers and that inspections of non-suspended scaffolds will be required.

nec=Not elsewhere classified.

In addition, OSHA has drafted the final standard for scaffolds in the construction industry to achieve adequate protection for affected employees while imposing minimal impacts on small employers. For example, the final rule maintains the performance-oriented approach of the proposed standard, allowing employers the flexibility to take workplace conditions into account when framing their compliance strategies. In addition, OSHA considered and adopted several alternatives designed to minimize small business impacts. For example, revisions reflected in the final standard's requirements for fall protection (grandfathering existing guardrail systems and allowing some use of crossbracing in lieu of guardrails)

will enable small entities to minimize their compliance burdens. Accordingly, OSHA has determined that the final rule effectively addresses small employer concerns.

#### V. Environmental Assessment

##### *Finding of No Significant Impact*

This final rule and its major alternatives have been reviewed in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.), the Guidelines of the Council on Environmental Quality (CEQ) (40 CFR part 1500), and OSHA's DOL NEPA Procedures (29 CFR part 11). As a result of this review, the Assistant Secretary for OSHA has determined that the final

rule will have no significant environmental impact.

The revisions to Subpart L—Scaffolds focus on the reduction of accidents or injuries by means of work practices and procedures, proper use and handling of equipment, and training, as well as on changes in language, definition, and format of the standard. These revisions do not impact on air, water, or soil quality, plant or animal life, the use of land, or other aspect of the environment. As such, these revisions are, therefore, categorized as excluded actions according to subpart B, § 11.10, of the DOL NEPA regulation.

#### VI. Pertinent Legal Authority

The purpose of the Occupational Safety and Health Act, 29 U.S.C. §§ 651

*et seq.* ("the Act"), is "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources." 29 U.S.C. § 651(b). To achieve this goal, Congress authorized the Secretary of Labor to promulgate and enforce occupational safety and health standards. 29 U.S.C. §§ 655(a) (authorizing summary adoption of existing consensus and federal standards within two years of Act's enactment), 655(b) (authorizing promulgation of standards pursuant to notice and comment), 654(b) (requiring employers to comply with OSHA standards).

A safety or health standard is a standard "which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment." 29 U.S.C. § 652(8).

A standard is reasonably necessary or appropriate within the meaning of Section 652(8) if it substantially reduces or eliminates significant risk, and is economically feasible, technologically feasible, cost effective, consistent with prior Agency action or a justified departure, supported by substantial evidence, and is better able to effectuate the Act's purposes than any national consensus standard it supersedes. See 58 Fed. Reg. 16612-16616 (March 30, 1993).

OSHA has generally considered, at minimum, a fatality risk of 1/1000 over a 45-year working lifetime to be a significant health risk. See the Benzene standard, *Industrial Union Dep't v. American Petroleum Institute*, 448 U.S. 607, 646 (1980); the Asbestos standard, *Building and Constr. Trades Dep't, AFL-CIO v. Brock*, 838 F.2d 1258, 1265 (D.C. Cir 1988); the Formaldehyde standard, *International Union, UAW v. Pendergrass*, 878 F.2d 389, 392 (D.C. Cir 1989).

A standard is technologically feasible if the protective measures it requires already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be expected to be developed. *American Textile Mfrs. Institute v. OSHA*, 452 U.S. 490, 513 (1981) ("*ATMI*"); *AISI v. OSHA*, 939 F.2d 975, 980 (D.C. Cir. 1991).

A standard is economically feasible if industry can absorb or pass on the costs of compliance without threatening its long term profitability or competitive structure. See *ATMI*, 452 U.S. at 530 n. 55; *AISI*, 939 F.2d at 980.

A standard is cost effective if the protective measures it requires are the least costly of the available alternatives

that achieve the same level of protection. *ATMI*, 453 U.S. at 514 n. 32; *International Union, UAW v. OSHA*, 37 F.3d 665, 668 (D.C. Cir. 1994) ("*LOTO III*").

Section 6(b)(7) authorizes OSHA to include among a standard's requirements labeling, monitoring, medical testing and other information gathering and transmittal provisions. 29 U.S.C. § 655(b)(7).

All standards must be highly protective. See 58 Fed. Reg. at 16614-16615; *LOTO III*, 37 F.3d at 669. Finally, whenever practical, standards shall "be expressed in terms of objective criteria and of the performance desired." *Id.*

## VII. Recordkeeping

The Agency has estimated the paperwork burden of the final rule entitled "Scaffolds Used in the Construction Industry" under the guidelines of the Paperwork Reduction Act of 1995. Under that Act, burden is defined as the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal Agency. The Agency has concluded that there is only one collection of information in the final rule on "Scaffolds Used in the Construction Industry" that potentially could create a burden [as defined above] for the construction industry. The collection of information is located in § 1926.453(a)(2). This provision requires the employer to obtain a written certification from the manufacturer of aerial lifts under certain specified conditions. In particular, the requirement reads as follows:

Aerial lifts may be "field modified" for uses other than those intended by the manufacturer provided the modification has been certified in writing by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory, to be in conformity with all the applicable provisions of the ANSI A92.2-1969 and this section and to be at least as safe as the equipment was before modification.

This provision was adopted by OSHA in May 1971 as an established Federal standard which had been promulgated by the Bureau of Labor Standards for the Construction Industry in April 1971. OSHA failed to identify this provision as subject to the Paperwork Reduction Act of 1995 (PRA-95) and did not obtain approval from OMB for this collection as required by PRA-95. This error was discovered in the course of preparing the final rule for Scaffolds Used in the Construction Industry. This provision, currently located in § 1926.556(a)(2) is redesignated as § 1926.453(a)(2) and removed

unchanged from its present location in Subpart N to Subpart L (Scaffolds Used in the Construction Industry). Through this final rule, OSHA is soliciting comments on the burden associated with the collection. It is OSHA intent to review and analyze all comments received on the collection of information and then to seek proper approvals from OMB under PRA-95. Once approval is received, OSHA will publish a notice in the Federal Register to indicate the OMB Approval Number and the effective date of the provision.

## *Collections of Information: Request for Comments*

The Department of Labor, as part of its continuing effort to reduce paperwork and respondent burden, conducts a preclearance consultation program to provide the general public and Federal agencies with an opportunity to comment on proposed and/or continuing collections of information in accordance with the Paperwork Reduction Act of 1995 (PRA95) (44 U.S.C. 3506(c)(2)(A)). This program helps to ensure that requested data can be provided in the desired format, reporting burden (time and financial resources) is minimized, collection instruments are clearly understood, and the impact of collection requirements on the respondents can be properly assessed. Currently, OSHA is soliciting comments concerning the proposed approval for the paperwork requirements of 29 CFR part 1926, subpart L, Scaffolds used in the Construction Industry. Written comments should:

- Evaluate whether the proposed collection of information is necessary for the proper performance of the function of the agency, including whether the information will have a practical utility;
- Evaluate the accuracy of the Agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;
- Enhance the quality, utility, and clarity of the information to be collected; and
- Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submissions of responses.

## *Background*

OSHA in its final rule for Scaffolds Used in the Construction Industry is

redesignating existing § 1926.556 (subpart N), Aerial Lifts to § 1926.453 (subpart L), Aerial Lifts because these type of equipment are, in fact, scaffolds. The existing regulation, § 1926.556(a)(2), contained a requirement for manufacturer certification of "field modified" aerial lifts. This provision, along with the rest of § 1296.556, is being redesignated § 1926.453(a)(2) in this final rule.

OSHA believes that manufacturer certification of "field modified" aerial lifts is necessary to ensure that modifications to these types of scaffolds will not adversely affect the strength, stability, or other characteristics necessary for their safe use.

#### *Current Actions*

This notice requests OMB approval of the paperwork requirements in Scaffolds Used in the Construction Industry (29 CFR 1926, subpart L).

*Type of Review:* New.

*Agency:* Occupational Safety and Health Administration, U.S. Department of Labor.

*Title:* Scaffolds Used in the Construction Industry (29 CFR 1926, subpart L).

*OMB Number:* 1218-AA40.

*Agency Docket No.:* S-205.

*Frequency:* On occasion.

*Affected Public:* Business or other for-profit, Federal government, State and local governments.

*Number of respondents:* 10,000.

*Estimated Time per Respondent:* 2 hours.

*Total Estimated Cost:* \$513,200.

*Total Burden Hours:* 20,000.

Comments submitted in response to this notice will be summarized and/or included in the request for Office of Management and Budget approval of the information collection request. They will also become a matter of public record.

#### VIII. State Plan Standards

The 25 states and territories with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within 6 months of the publication date of the final rule. These states and territories are: Alaska, Arizona, California, Connecticut (for State and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, New York (for State and local government employees only), Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time as a comparable standard is promulgated, Federal OSHA will

provide interim enforcement assistance, as appropriate, in these states and territories.

#### IX. Federalism

The final rule has been reviewed in accordance with Executive Order 12612 (52 FR 41685, October 30, 1987) regarding Federalism. The Order requires that agencies, to the extent possible, refrain from limiting State policy options, consult with states prior to taking any actions that would restrict State policy options, and take such actions only when there is clear constitutional authority and the presence of a problem of national scope. The Order provides for preemption of State law only if there is a clear Congressional intent for the agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the Occupational Safety and Health Act (OSH Act), expresses Congress' clear intent to preempt State laws relating to issues with respect to which Federal OSHA has promulgated occupational safety and health standards. Under the OSH Act, a State can avoid preemption only if it submits, and obtains Federal approval of a plan for the development of such standards and their enforcement. Occupational safety and health standards developed by such Plan States must, among other things, be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Where such standards are applicable to products distributed or used in interstate commerce, they may not unduly burden commerce and must be justified by compelling local conditions, see section 18(c)(2).

The Federal standard on construction operations involving scaffolds addresses hazards that are not unique to any one state or region of the country. Nonetheless, States with occupational safety and health plans approved under section 18 of the OSH Act will be able to develop their own State standards to deal with any special problems which might be encountered in a particular State. Moreover, because this standard is written in general, performance-oriented terms, there is considerable flexibility to State plans to require, and for affected employers to use, methods of compliance which are appropriate to the working conditions covered by the standard.

In brief, this final rule addresses a clear national problem related to occupational safety and health in the construction industry. Those states which have elected to participate under section 18 of the OSH Act are not

preempted by this standard, and will be able to address any special conditions within the framework of the Federal Act while ensuring that the state standards are at least as effective as that standard.

#### List of Subjects in 29 CFR Part 1926

Construction industry, Construction safety, Occupational safety and health, Protective equipment, Safety, Scaffolds.

#### Authority

This document was prepared under the direction of Joseph A. Dear, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

Accordingly, pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 333), Secretary of Labor's Order No. 1-90 (55 FR 9033), and 29 CFR part 1911, 29 CFR part 1926 is amended as set forth below.

Signed at Washington, D.C., this 16th day of August 1996.

Joseph A. Dear,

*Assistant Secretary of Labor.*

#### PART 1926—[AMENDED]

1. Subpart L of Part 1926 is revised to read as follows:

##### **Subpart L—Scaffolds**

Sec.

1926.450 Scope, application and definitions applicable to this subpart.

1926.451 General requirements.

1926.452 Additional requirements applicable to specific types of scaffolds.

1926.453 Aerial lifts.

1926.454 Training.

Appendix A to Subpart L—Scaffolds

Appendix B to Subpart L—Scaffolds

Appendix C to Subpart L—Scaffolds

Appendix D to Subpart L—Scaffolds

Appendix E to Subpart L—Scaffolds

Authority: Section 107, Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 333); Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 1-90 (55 FR 9033); and 29 CFR Part 1911.

##### **Subpart L—Scaffolds**

##### **§ 1926.450 Scope, application and definitions applicable to this subpart.**

(a) *Scope and application.* This subpart applies to all scaffolds used in workplaces covered by this part. It does not apply to crane or derrick suspended personnel platforms, which are covered by § 1926.550(g). The criteria for aerial lifts are set out exclusively in § 1926.453.

(b) *Definitions. Adjustable suspension scaffold* means a suspension scaffold equipped with a hoist(s) that can be operated by an employee(s) on the scaffold.

*Bearer (putlog)* means a horizontal transverse scaffold member (which may be supported by ledgers or runners) upon which the scaffold platform rests and which joins scaffold uprights, posts, poles, and similar members.

*Boatswains' chair* means a single-point adjustable suspension scaffold consisting of a seat or sling designed to support one employee in a sitting position.

*Body belt (safety belt)* means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

*Body harness* means a design of straps which may be secured about the employee in a manner to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders, with means for attaching it to other components of a personal fall arrest system.

*Brace* means a rigid connection that holds one scaffold member in a fixed position with respect to another member, or to a building or structure.

*Bricklayers' square scaffold* means a supported scaffold composed of framed squares which support a platform.

*Carpenters' bracket scaffold* means a supported scaffold consisting of a platform supported by brackets attached to building or structural walls.

*Catenary scaffold* means a suspension scaffold consisting of a platform supported by two essentially horizontal and parallel ropes attached to structural members of a building or other structure. Additional support may be provided by vertical pickups.

*Chimney hoist* means a multi-point adjustable suspension scaffold used to provide access to work inside chimneys. (See "Multi-point adjustable suspension scaffold".)

*Cleat* means a structural block used at the end of a platform to prevent the platform from slipping off its supports. Cleats are also used to provide footing on sloped surfaces such as crawling boards.

*Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

*Continuous run scaffold (Run scaffold)* means a two-point or multi-point adjustable suspension scaffold constructed using a series of

interconnected braced scaffold members or supporting structures erected to form a continuous scaffold.

*Coupler* means a device for locking together the tubes of a tube and coupler scaffold.

*Crawling board (chicken ladder)* means a supported scaffold consisting of a plank with cleats spaced and secured to provide footing, for use on sloped surfaces such as roofs.

*Deceleration device* means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyard, or automatic self-retracting lifeline lanyard, which dissipates a substantial amount of energy during a fall arrest or limits the energy imposed on an employee during fall arrest.

*Double pole (independent pole) scaffold* means a supported scaffold consisting of a platform(s) resting on cross beams (bearers) supported by ledgers and a double row of uprights independent of support (except ties, guys, braces) from any structure.

*Equivalent* means alternative designs, materials or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

*Exposed power lines* means electrical power lines which are accessible to employees and which are not shielded from contact. Such lines do not include extension cords or power tool cords.

*Eye or Eye splice* means a loop with or without a thimble at the end of a wire rope.

*Fabricated decking and planking* means manufactured platforms made of wood (including laminated wood, and solid sawn wood planks), metal or other materials.

*Fabricated frame scaffold (tubular welded frame scaffold)* means a scaffold consisting of a platform(s) supported on fabricated end frames with integral posts, horizontal bearers, and intermediate members.

*Failure* means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

*Float (ship) scaffold* means a suspension scaffold consisting of a braced platform resting on two parallel bearers and hung from overhead supports by ropes of fixed length.

*Form scaffold* means a supported scaffold consisting of a platform supported by brackets attached to formwork.

*Guardrail system* means a vertical barrier, consisting of, but not limited to, top rails, midrails, and posts, erected to

prevent employees from falling off a scaffold platform or walkway to lower levels.

*Hoist* means a manual or power-operated mechanical device to raise or lower a suspended scaffold.

*Horse scaffold* means a supported scaffold consisting of a platform supported by construction horses (saw horses). Horse scaffolds constructed of metal are sometimes known as trestle scaffolds.

*Independent pole scaffold* (see "Double pole scaffold").

*Interior hung scaffold* means a suspension scaffold consisting of a platform suspended from the ceiling or roof structure by fixed length supports.

*Ladder jack scaffold* means a supported scaffold consisting of a platform resting on brackets attached to ladders.

*Ladder stand* means a mobile, fixed-size, self-supporting ladder consisting of a wide flat tread ladder in the form of stairs.

*Landing* means a platform at the end of a flight of stairs.

*Large area scaffold* means a pole scaffold, tube and coupler scaffold, systems scaffold, or fabricated frame scaffold erected over substantially the entire work area. For example: a scaffold erected over the entire floor area of a room.

*Lean-to scaffold* means a supported scaffold which is kept erect by tilting it toward and resting it against a building or structure.

*Lifeline* means a component consisting of a flexible line that connects to an anchorage at one end to hang vertically (vertical lifeline), or that connects to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

*Lower levels* means areas below the level where the employee is located and to which an employee can fall. Such areas include, but are not limited to, ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, materials, water, and equipment.

*Masons' adjustable supported scaffold* (see "Self-contained adjustable scaffold").

*Masons' multi-point adjustable suspension scaffold* means a continuous run suspension scaffold designed and used for masonry operations.

*Maximum intended load* means the total load of all persons, equipment, tools, materials, transmitted loads, and other loads reasonably anticipated to be applied to a scaffold or scaffold component at any one time.

*Mobile scaffold* means a powered or unpowered, portable, caster or wheel-mounted supported scaffold.

*Multi-level suspended scaffold* means a two-point or multi-point adjustable suspension scaffold with a series of platforms at various levels resting on common stirrups.

*Multi-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform(s) which is suspended by more than two ropes from overhead supports and equipped with means to raise and lower the platform to desired work levels. Such scaffolds include chimney hoists.

*Needle beam scaffold* means a platform suspended from needle beams.

*Open sides and ends* means the edges of a platform that are more than 14 inches (36 cm) away horizontally from a sturdy, continuous, vertical surface (such as a building wall) or a sturdy, continuous horizontal surface (such as a floor), or a point of access. Exception: For plastering and lathing operations the horizontal threshold distance is 18 inches (46 cm).

*Outrigger* means the structural member of a supported scaffold used to increase the base width of a scaffold in order to provide support for and increased stability of the scaffold.

*Outrigger beam (Thrustout)* means the structural member of a suspension scaffold or outrigger scaffold which provides support for the scaffold by extending the scaffold point of attachment to a point out and away from the structure or building.

*Outrigger scaffold* means a supported scaffold consisting of a platform resting on outrigger beams (thrustouts) projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside the building or structure.

*Overhand bricklaying* means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. It includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

*Personal fall arrest system* means a system used to arrest an employee's fall. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or combinations of these.

*Platform* means a work surface elevated above lower levels. Platforms can be constructed using individual wood planks, fabricated planks, fabricated decks, and fabricated platforms.

*Pole scaffold* (see definitions for "Single-pole scaffold" and "Double (independent) pole scaffold").

*Power operated hoist* means a hoist which is powered by other than human energy.

*Pump jack scaffold* means a supported scaffold consisting of a platform supported by vertical poles and movable support brackets.

*Qualified* means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project.

*Rated load* means the manufacturer's specified maximum load to be lifted by a hoist or to be applied to a scaffold or scaffold component.

*Repair bracket scaffold* means a supported scaffold consisting of a platform supported by brackets which are secured in place around the circumference or perimeter of a chimney, stack, tank or other supporting structure by one or more wire ropes placed around the supporting structure.

*Roof bracket scaffold* means a rooftop supported scaffold consisting of a platform resting on angular-shaped supports.

*Runner (ledger or ribbon)* means the lengthwise horizontal spacing or bracing member which may support the bearers.

*Scaffold* means any temporary elevated platform (supported or suspended) and its supporting structure (including points of anchorage), used for supporting employees or materials or both.

*Self-contained adjustable scaffold* means a combination supported and suspension scaffold consisting of an adjustable platform(s) mounted on an independent supporting frame(s) not a part of the object being worked on, and which is equipped with a means to permit the raising and lowering of the platform(s). Such systems include rolling roof rigs, rolling outrigger systems, and some masons' adjustable supported scaffolds.

*Shore scaffold* means a supported scaffold which is placed against a building or structure and held in place with props.

*Single-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform suspended by one rope from an overhead support and equipped with means to permit the movement of the platform to desired work levels.

*Single-pole scaffold* means a supported scaffold consisting of a platform(s) resting on bearers, the

outside ends of which are supported on runners secured to a single row of posts or uprights, and the inner ends of which are supported on or in a structure or building wall.

*Stair tower (Scaffold stairway/tower)* means a tower comprised of scaffold components and which contains internal stairway units and rest platforms. These towers are used to provide access to scaffold platforms and other elevated points such as floors and roofs.

*Stall load* means the load at which the prime-mover of a power-operated hoist stalls or the power to the prime-mover is automatically disconnected.

*Step, platform, and trestle ladder scaffold* means a platform resting directly on the rungs of step ladders or trestle ladders.

*Stilts* means a pair of poles or similar supports with raised footrests, used to permit walking above the ground or working surface.

*Stonesetters' multi-point adjustable suspension scaffold* means a continuous run suspension scaffold designed and used for stonesetters' operations.

*Supported scaffold* means one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support.

*Suspension scaffold* means one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s).

*System scaffold* means a scaffold consisting of posts with fixed connection points that accept runners, bearers, and diagonals that can be interconnected at predetermined levels.

*Tank builders' scaffold* means a supported scaffold consisting of a platform resting on brackets that are either directly attached to a cylindrical tank or attached to devices that are attached to such a tank.

*Top plate bracket scaffold* means a scaffold supported by brackets that hook over or are attached to the top of a wall. This type of scaffold is similar to carpenters' bracket scaffolds and form scaffolds and is used in residential construction for setting trusses.

*Tube and coupler scaffold* means a supported or suspended scaffold consisting of a platform(s) supported by tubing, erected with coupling devices connecting uprights, braces, bearers, and runners.

*Tubular welded frame scaffold* (see "Fabricated frame scaffold").

*Two-point suspension scaffold (swing stage)* means a suspension scaffold consisting of a platform supported by hangers (stirrups) suspended by two ropes from overhead supports and equipped with means to permit the



raising and lowering of the platform to desired work levels.

*Unstable objects* means items whose strength, configuration, or lack of stability may allow them to become dislocated and shift and therefore may not properly support the loads imposed on them. Unstable objects do not constitute a safe base support for scaffolds, platforms, or employees. Examples include, but are not limited to, barrels, boxes, loose brick, and concrete blocks.

*Vertical pickup* means a rope used to support the horizontal rope in catenary scaffolds.

*Walkway* means a portion of a scaffold platform used only for access and not as a work level.

*Window jack scaffold* means a platform resting on a bracket or jack which projects through a window opening.

#### § 1926.451 General requirements.

This section does not apply to aerial lifts, the criteria for which are set out exclusively in § 1926.453.

(a) *Capacity* (1) Except as provided in paragraphs (a)(2), (a)(3), (a)(4), (a)(5) and (g) of this section, each scaffold and scaffold component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it.

(2) Direct connections to roofs and floors, and counterweights used to balance adjustable suspension scaffolds, shall be capable of resisting at least 4 times the tipping moment imposed by the scaffold operating at either the rated load of the hoist, or 1.5 (minimum) times the tipping moment imposed by the scaffold operating at the stall load of the hoist, whichever is greater.

(3) Each suspension rope, including connecting hardware, used on non-adjustable suspension scaffolds shall be capable of supporting, without failure, at least 6 times the maximum intended load applied or transmitted to that rope.

(4) Each suspension rope, including connecting hardware, used on adjustable suspension scaffolds shall be capable of supporting, without failure, at least 6 times the maximum intended load applied or transmitted to that rope with the scaffold operating at either the rated load of the hoist, or 2 (minimum) times the stall load of the hoist, whichever is greater.

(5) The stall load of any scaffold hoist shall not exceed 3 times its rated load.

(6) Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart contains

examples of criteria that will enable an employer to comply with paragraph (a) of this section.

(b) *Scaffold platform construction.* (1) Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrail supports as follows:

(i) Each platform unit (e.g., scaffold plank, fabricated plank, fabricated deck, or fabricated platform) shall be installed so that the space between adjacent units and the space between the platform and the uprights is no more than 1 inch (2.5 cm) wide, except where the employer can demonstrate that a wider space is necessary (for example, to fit around uprights when side brackets are used to extend the width of the platform).

(ii) Where the employer makes the demonstration provided for in paragraph (b)(1)(i) of this section, the platform shall be planked or decked as fully as possible and the remaining open space between the platform and the uprights shall not exceed 9½ inches (24.1 cm).

Exception to paragraph (b)(1): The requirement in paragraph (b)(1) to provide full planking or decking does not apply to platforms used solely as walkways or solely by employees performing scaffold erection or dismantling. In these situations, only the planking that the employer establishes is necessary to provide safe working conditions is required.

(2) Except as provided in paragraphs (b)(2)(i) and (b)(2)(ii) of this section, each scaffold platform and walkway shall be at least 18 inches (46 cm) wide.

(i) Each ladder jack scaffold, top plate bracket scaffold, roof bracket scaffold, and pump jack scaffold shall be at least 12 inches (30 cm) wide. There is no minimum width requirement for boatswains' chairs.

(ii) Where scaffolds must be used in areas that the employer can demonstrate are so narrow that platforms and walkways cannot be at least 18 inches (46 cm) wide, such platforms and walkways shall be as wide as feasible, and employees on those platforms and walkways shall be protected from fall hazards by the use of guardrails and/or personal fall arrest systems.

(3) Except as provided in paragraphs (b)(3) (i) and (ii) of this section, the front edge of all platforms shall not be more than 14 inches (36 cm) from the face of the work, unless guardrail systems are erected along the front edge and/or personal fall arrest systems are used in accordance with paragraph (g) of this section to protect employees from falling.

(i) The maximum distance from the face for outrigger scaffolds shall be 3 inches (8 cm);

(ii) The maximum distance from the face for plastering and lathing operations shall be 18 inches (46 cm).

(4) Each end of a platform, unless cleated or otherwise restrained by hooks or equivalent means, shall extend over the centerline of its support at least 6 inches (15 cm).

(5)(i) Each end of a platform 10 feet or less in length shall not extend over its support more than 12 inches (30 cm) unless the platform is designed and installed so that the cantilevered portion of the platform is able to support employees and/or materials without tipping, or has guardrails which block employee access to the cantilevered end.

(ii) Each platform greater than 10 feet in length shall not extend over its support more than 18 inches (46 cm), unless it is designed and installed so that the cantilevered portion of the platform is able to support employees without tipping, or has guardrails which block employee access to the cantilevered end.

(6) On scaffolds where scaffold planks are abutted to create a long platform, each abutted end shall rest on a separate support surface. This provision does not preclude the use of common support members, such as "T" sections, to support abutting planks, or hook on platforms designed to rest on common supports.

(7) On scaffolds where platforms are overlapped to create a long platform, the overlap shall occur only over supports, and shall not be less than 12 inches (30 cm) unless the platforms are nailed together or otherwise restrained to prevent movement.

(8) At all points of a scaffold where the platform changes direction, such as turning a corner, any platform that rests on a bearer at an angle other than a right angle shall be laid first, and platforms which rest at right angles over the same bearer shall be laid second, on top of the first platform.

(9) Wood platforms shall not be covered with opaque finishes, except that platform edges may be covered or marked for identification. Platforms may be coated periodically with wood preservatives, fire-retardant finishes, and slip-resistant finishes; however, the coating may not obscure the top or bottom wood surfaces.

(10) Scaffold components manufactured by different manufacturers shall not be intermixed unless the components fit together without force and the scaffold's structural integrity is maintained by the



user. Scaffold components manufactured by different manufacturers shall not be modified in order to intermix them unless a competent person determines the resulting scaffold is structurally sound.

(11) Scaffold components made of dissimilar metals shall not be used together unless a competent person has determined that galvanic action will not reduce the strength of any component to a level below that required by paragraph (a)(1) of this section.

(c) *Criteria for supported scaffolds.* (1) Supported scaffolds with a height to base width (including outrigger supports, if used) ratio of more than four to one (4:1) shall be restrained from tipping by guying, tying, bracing, or equivalent means, as follows:

(i) Guys, ties, and braces shall be installed at locations where horizontal members support both inner and outer legs.

(ii) Guys, ties, and braces shall be installed according to the scaffold manufacturer's recommendations or at the closest horizontal member to the 4:1 height and be repeated vertically at locations of horizontal members every 20 feet (6.1 m) or less thereafter for scaffolds 3 feet (0.91 m) wide or less, and every 26 feet (7.9 m) or less thereafter for scaffolds greater than 3 feet (0.91 m) wide. The top guy, tie or brace of completed scaffolds shall be placed no further than the 4:1 height from the top. Such guys, ties and braces shall be installed at each end of the scaffold and at horizontal intervals not to exceed 30 feet (9.1 m) (measured from one end [not both] towards the other).

(iii) Ties, guys, braces, or outriggers shall be used to prevent the tipping of supported scaffolds in all circumstances where an eccentric load, such as a cantilevered work platform, is applied or is transmitted to the scaffold.

(2) Supported scaffold poles, legs, posts, frames, and uprights shall bear on base plates, mud sills or other adequate firm foundation.

(i) Footings shall be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.

(ii) Unstable objects shall not be used to support scaffolds or platform units.

(iii) Unstable objects shall not be used as working platforms.

(iv) Front-end loaders and similar pieces of equipment shall not be used to support scaffold platforms unless they have been specifically designed by the manufacturer for such use.

(v) Fork-lifts shall not be used to support scaffold platforms unless the entire platform is attached to the fork and the fork-lift is not moved

horizontally while the platform is occupied.

(3) Supported scaffold poles, legs, posts, frames, and uprights shall be plumb and braced to prevent swaying and displacement.

(d) *Criteria for suspension scaffolds.*

(1) All suspension scaffold support devices, such as outrigger beams, cornice hooks, parapet clamps, and similar devices, shall rest on surfaces capable of supporting at least 4 times the load imposed on them by the scaffold operating at the rated load of the hoist (or at least 1.5 times the load imposed on them by the scaffold at the stall capacity of the hoist, whichever is greater).

(2) Suspension scaffold outrigger beams, when used, shall be made of structural metal or equivalent strength material, and shall be restrained to prevent movement.

(3) The inboard ends of suspension scaffold outrigger beams shall be stabilized by bolts or other direct connections to the floor or roof deck, or they shall have their inboard ends stabilized by counterweights, except masons' multi-point adjustable suspension scaffold outrigger beams shall not be stabilized by counterweights.

(i) Before the scaffold is used, direct connections shall be evaluated by a competent person who shall confirm, based on the evaluation, that the supporting surfaces are capable of supporting the loads to be imposed. In addition, masons' multi-point adjustable suspension scaffold connections shall be designed by an engineer experienced in such scaffold design.

(ii) Counterweights shall be made of non-flowable material. Sand, gravel and similar materials that can be easily dislocated shall not be used as counterweights.

(iii) Only those items specifically designed as counterweights shall be used to counterweight scaffold systems. Construction materials such as, but not limited to, masonry units and rolls of roofing felt, shall not be used as counterweights.

(iv) Counterweights shall be secured by mechanical means to the outrigger beams to prevent accidental displacement.

(v) Counterweights shall not be removed from an outrigger beam until the scaffold is disassembled.

(vi) Outrigger beams which are not stabilized by bolts or other direct connections to the floor or roof deck shall be secured by tiebacks.

(vii) Tiebacks shall be equivalent in strength to the suspension ropes.

(viii) Outrigger beams shall be placed perpendicular to its bearing support (usually the face of the building or structure). However, where the employer can demonstrate that it is not possible to place an outrigger beam perpendicular to the face of the building or structure because of obstructions that cannot be moved, the outrigger beam may be placed at some other angle, provided opposing angle tiebacks are used.

(ix) Tiebacks shall be secured to a structurally sound anchorage on the building or structure. Sound anchorages include structural members, but do not include standpipes, vents, other piping systems, or electrical conduit.

(x) Tiebacks shall be installed perpendicular to the face of the building or structure, or opposing angle tiebacks shall be installed. Single tiebacks installed at an angle are prohibited.

(4) Suspension scaffold outrigger beams shall be:

(i) Provided with stop bolts or shackles at both ends;

(ii) Securely fastened together with the flanges turned out when channel iron beams are used in place of I-beams;

(iii) Installed with all bearing supports perpendicular to the beam center line;

(iv) Set and maintained with the web in a vertical position; and

(v) When an outrigger beam is used, the shackle or clevis with which the rope is attached to the outrigger beam shall be placed directly over the center line of the stirrup.

(5) Suspension scaffold support devices such as cornice hooks, roof hooks, roof irons, parapet clamps, or similar devices shall be:

(i) Made of steel, wrought iron, or materials of equivalent strength;

(ii) Supported by bearing blocks; and

(iii) Secured against movement by tiebacks installed at right angles to the face of the building or structure, or opposing angle tiebacks shall be installed and secured to a structurally sound point of anchorage on the building or structure. Sound points of anchorage include structural members, but do not include standpipes, vents, other piping systems, or electrical conduit.

(iv) Tiebacks shall be equivalent in strength to the hoisting rope.

(6) When winding drum hoists are used on a suspension scaffold, they shall contain not less than four wraps of the suspension rope at the lowest point of scaffold travel. When other types of hoists are used, the suspension ropes shall be long enough to allow the scaffold to be lowered to the level below without the rope end passing through

the hoist, or the rope end shall be configured or provided with means to prevent the end from passing through the hoist.

(7) The use of repaired wire rope as suspension rope is prohibited.

(8) Wire suspension ropes shall not be joined together except through the use of eye splice thimbles connected with shackles or coverplates and bolts.

(9) The load end of wire suspension ropes shall be equipped with proper size thimbles and secured by eyesplicing or equivalent means.

(10) Ropes shall be inspected for defects by a competent person prior to each workshift and after every occurrence which could affect a rope's integrity. Ropes shall be replaced if any of the following conditions exist:

(i) Any physical damage which impairs the function and strength of the rope.

(ii) Kinks that might impair the tracking or wrapping of rope around the drum(s) or sheave(s).

(iii) Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay.

(iv) Abrasion, corrosion, scrubbing, flattening or peening causing loss of more than one-third of the original diameter of the outside wires.

(v) Heat damage caused by a torch or any damage caused by contact with electrical wires.

(vi) Evidence that the secondary brake has been activated during an overspeed condition and has engaged the suspension rope.

(11) Swaged attachments or spliced eyes on wire suspension ropes shall not be used unless they are made by the wire rope manufacturer or a qualified person.

(12) When wire rope clips are used on suspension scaffolds:

(i) There shall be a minimum of 3 wire rope clips installed, with the clips a minimum of 6 rope diameters apart;

(ii) Clips shall be installed according to the manufacturer's recommendations;

(iii) Clips shall be retightened to the manufacturer's recommendations after the initial loading;

(iv) Clips shall be inspected and retightened to the manufacturer's recommendations at the start of each workshift thereafter;

(v) U-bolt clips shall not be used at the point of suspension for any scaffold hoist;

(vi) When U-bolt clips are used, the U-bolt shall be placed over the dead end of the rope, and the saddle shall be placed over the live end of the rope.

(13) Suspension scaffold power-operated hoists and manual hoists shall be tested and listed by a qualified testing laboratory.

(14) Gasoline-powered equipment and hoists shall not be used on suspension scaffolds.

(15) Gears and brakes of power-operated hoists used on suspension scaffolds shall be enclosed.

(16) In addition to the normal operating brake, suspension scaffold power-operated hoists and manually operated hoists shall have a braking device or locking pawl which engages automatically when a hoist makes either of the following uncontrolled movements: an instantaneous change in momentum or an accelerated overspeed.

(17) Manually operated hoists shall require a positive crank force to descend.

(18) Two-point and multi-point suspension scaffolds shall be tied or otherwise secured to prevent them from swaying, as determined to be necessary based on an evaluation by a competent person. Window cleaners' anchors shall not be used for this purpose.

(19) Devices whose sole function is to provide emergency escape and rescue shall not be used as working platforms. This provision does not preclude the use of systems which are designed to function both as suspension scaffolds and emergency systems.

(e) Access. This paragraph applies to scaffold access for all employees. Access requirements for employees erecting or dismantling supported scaffolds are specifically addressed in paragraph (e)(9) of this section.

(1) When scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, portable ladders, hook-on ladders, attachable ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Crossbraces shall not be used as a means of access.

(2) Portable, hook-on, and attachable ladders (Additional requirements for the proper construction and use of portable ladders are contained in subpart X of this part—Stairways and Ladders):

(i) Portable, hook-on, and attachable ladders shall be positioned so as not to tip the scaffold;

(ii) Hook-on and attachable ladders shall be positioned so that their bottom rung is not more than 24 inches (61 cm) above the scaffold supporting level;

(iii) When hook-on and attachable ladders are used on a supported scaffold more than 35 feet (10.7 m) high, they shall have rest platforms at 35-foot (10.7 m) maximum vertical intervals.

(iv) Hook-on and attachable ladders shall be specifically designed for use with the type of scaffold used;

(v) Hook-on and attachable ladders shall have a minimum rung length of 11½ inches (29 cm); and

(vi) Hook-on and attachable ladders shall have uniformly spaced rungs with a maximum spacing between rungs of 16¾ inches.

(3) Stairway-type ladders shall:

(i) Be positioned such that their bottom step is not more than 24 inches (61 cm) above the scaffold supporting level;

(ii) Be provided with rest platforms at 12 foot (3.7 m) maximum vertical intervals;

(iii) Have a minimum step width of 16 inches (41 cm), except that mobile scaffold stairway-type ladders shall have a minimum step width of 11½ inches (30 cm); and

(iv) Have slip-resistant treads on all steps and landings.

(4) Stairtowers (scaffold stairway/towers) shall be positioned such that their bottom step is not more than 24 inches (61 cm.) above the scaffold supporting level.

(i) A stairrail consisting of a toprail and a midrail shall be provided on each side of each scaffold stairway.

(ii) The toprail of each stairrail system shall also be capable of serving as a handrail, unless a separate handrail is provided.

(iii) Handrails, and toprails that serve as handrails, shall provide an adequate handhold for employees grasping them to avoid falling.

(iv) Stairrail systems and handrails shall be surfaced to prevent injury to employees from punctures or lacerations, and to prevent snagging of clothing.

(v) The ends of stairrail systems and handrails shall be constructed so that they do not constitute a projection hazard.

(vi) Handrails, and toprails that are used as handrails, shall be at least 3 inches (7.6 cm) from other objects.

(vii) Stairrails shall be not less than 28 inches (71 cm) nor more than 37 inches (94 cm) from the upper surface of the stairrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread.

(viii) A landing platform at least 18 inches (45.7 cm) wide by at least 18 inches (45.7 cm) long shall be provided at each level.

(ix) Each scaffold stairway shall be at least 18 inches (45.7 cm) wide between stairrails.

(x) Treads and landings shall have slip-resistant surfaces.

(xi) Stairways shall be installed between 40 degrees and 60 degrees from the horizontal.

(xii) Guardrails meeting the requirements of paragraph (g)(4) of this section shall be provided on the open sides and ends of each landing.

(xiii) Riser height shall be uniform, within 1/4 inch, (0.6 cm) for each flight of stairs. Greater variations in riser height are allowed for the top and bottom steps of the entire system, not for each flight of stairs.

(xiv) Tread depth shall be uniform, within 1/4 inch, for each flight of stairs.

(5) Ramps and walkways. (i) Ramps and walkways 6 feet (1.8 m) or more above lower levels shall have guardrail systems which comply with subpart M of this part—Fall Protection;

(ii) No ramp or walkway shall be inclined more than a slope of one (1) vertical to three (3) horizontal (20 degrees above the horizontal).

(iii) If the slope of a ramp or a walkway is steeper than one (1) vertical in eight (8) horizontal, the ramp or walkway shall have cleats not more than fourteen (14) inches (35 cm) apart which are securely fastened to the planks to provide footing.

(6) Integral prefabricated scaffold access frames shall:

(i) Be specifically designed and constructed for use as ladder rungs;

(ii) Have a rung length of at least 8 inches (20 cm);

(iii) Not be used as work platforms when rungs are less than 11 1/2 inches in length, unless each affected employee uses fall protection, or a positioning device, which complies with § 1926.502;

(iv) Be uniformly spaced within each frame section;

(v) Be provided with rest platforms at 35-foot (10.7 m) maximum vertical intervals on all supported scaffolds more than 35 feet (10.7 m) high; and

(vi) Have a maximum spacing between rungs of 16 3/4 inches (43 cm). Non-uniform rung spacing caused by joining end frames together is allowed, provided the resulting spacing does not exceed 16 3/4 inches (43 cm).

(7) Steps and rungs of ladder and stairway type access shall line up vertically with each other between rest platforms.

(8) Direct access to or from another surface shall be used only when the scaffold is not more than 14 inches (36 cm) horizontally and not more than 24 inches (61 cm) vertically from the other surface.

(9) Effective September 2, 1997, access for employees erecting or dismantling supported scaffolds shall be in accordance with the following:

(i) The employer shall provide safe means of access for each employee erecting or dismantling a scaffold where the provision of safe access is feasible and does not create a greater hazard. The employer shall have a competent person determine whether it is feasible or would pose a greater hazard to provide, and have employees use a safe means of access. This determination shall be based on site conditions and the type of scaffold being erected or dismantled.

(ii) Hook-on or attachable ladders shall be installed as soon as scaffold erection has progressed to a point that permits safe installation and use.

(iii) When erecting or dismantling tubular welded frame scaffolds, (end) frames, with horizontal members that

are parallel, level and are not more than 22 inches apart vertically may be used as climbing devices for access, provided they are erected in a manner that creates a usable ladder and provides good hand hold and foot space.

(iv) Cross braces on tubular welded frame scaffolds shall not be used as a means of access or egress.

(f) Use. (1) Scaffolds and scaffold components shall not be loaded in excess of their maximum intended loads or rated capacities, whichever is less.

(2) The use of shore or lean-to scaffolds is prohibited.

(3) Scaffolds and scaffold components shall be inspected for visible defects by a competent person before each work shift, and after any occurrence which could affect a scaffold's structural integrity.

(4) Any part of a scaffold damaged or weakened such that its strength is less than that required by paragraph (a) of this section shall be immediately repaired or replaced, braced to meet those provisions, or removed from service until repaired.

(5) Scaffolds shall not be moved horizontally while employees are on them, unless they have been designed by a registered professional engineer specifically for such movement or, for mobile scaffolds, where the provisions of § 1926.452(w) are followed.

(6) The clearance between scaffolds and power lines shall be as follows: Scaffolds shall not be erected, used, dismantled, altered, or moved such that they or any conductive material handled on them might come closer to exposed and energized power lines than as follows:

Insulated lines voltage	Minimum distance	Alternatives
Less than 300 volts .....	3 feet (0.9 M).	2 times the length of the line insulator, but never less than 10 feet (3.1 m).
More than 50 kv .....	10 feet (3.1 M) plus 4.0 inches (10 cm) for each 1 kv over 50 kv.	
Uninsulated lines voltage	Minimum distance	Alternatives
Less than 50 kv .....	10 feet (3.1 M).	2 times the length of the line insulator, but never less than 10 feet (3.1 m).
More than 50 kv .....	10 feet (3.1 M) plus 4.0 inches (10 cm) for each 1 kv over 50 kv.	

Exception to paragraph (b)(6): Scaffolds and materials may be closer to power lines than specified above where such clearance is necessary for performance of work, and only after the utility company, or electrical system operator, has been notified of the need to work closer and the utility company, or electrical system operator, has deenergized the lines, relocated the

lines, or installed protective coverings to prevent accidental contact with the lines.

(7) Scaffolds shall be erected, moved, dismantled, or altered only under the supervision and direction of a competent person qualified in scaffold erection, moving, dismantling or alteration. Such activities shall be performed only by experienced and

trained employees selected for such work by the competent person.

(8) Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

(9) Where swinging loads are being hoisted onto or near scaffolds such that the loads might contact the scaffold, tag lines or equivalent measures to control the loads shall be used.

(10) Suspension ropes supporting adjustable suspension scaffolds shall be of a diameter large enough to provide sufficient surface area for the functioning of brake and hoist mechanisms.

(11) Suspension ropes shall be shielded from heat-producing processes. When acids or other corrosive substances are used on a scaffold, the ropes shall be shielded, treated to protect against the corrosive substances, or shall be of a material that will not be damaged by the substance being used.

(12) Work on or from scaffolds is prohibited during storms or high winds unless a competent person has determined that it is safe for employees to be on the scaffold and those employees are protected by a personal fall arrest system or wind screens. Wind screens shall not be used unless the scaffold is secured against the anticipated wind forces imposed.

(13) Debris shall not be allowed to accumulate on platforms.

(14) Makeshift devices, such as but not limited to boxes and barrels, shall not be used on top of scaffold platforms to increase the working level height of employees.

(15) Ladders shall not be used on scaffolds to increase the working level height of employees, except on large area scaffolds where employers have satisfied the following criteria:

(i) When the ladder is placed against a structure which is not a part of the scaffold, the scaffold shall be secured against the sideways thrust exerted by the ladder;

(ii) The platform units shall be secured to the scaffold to prevent their movement;

(iii) The ladder legs shall be on the same platform or other means shall be provided to stabilize the ladder against unequal platform deflection, and

(iv) The ladder legs shall be secured to prevent them from slipping or being pushed off the platform.

(16) Platforms shall not deflect more than  $\frac{1}{60}$  of the span when loaded.

(17) To reduce the possibility of welding current arcing through the suspension wire rope when performing welding from suspended scaffolds, the following precautions shall be taken, as applicable:

(i) An insulated thimble shall be used to attach each suspension wire rope to its hanging support (such as cornice hook or outrigger). Excess suspension wire rope and any additional

independent lines from grounding shall be insulated;

(ii) The suspension wire rope shall be covered with insulating material extending at least 4 feet (1.2 m) above the hoist. If there is a tail line below the hoist, it shall be insulated to prevent contact with the platform. The portion of the tail line that hangs free below the scaffold shall be guided or retained, or both, so that it does not become grounded;

(iii) Each hoist shall be covered with insulated protective covers;

(iv) In addition to a work lead attachment required by the welding process, a grounding conductor shall be connected from the scaffold to the structure. The size of this conductor shall be at least the size of the welding process work lead, and this conductor shall not be in series with the welding process or the work piece;

(v) If the scaffold grounding lead is disconnected at any time, the welding machine shall be shut off; and

(vi) An active welding rod or uninsulated welding lead shall not be allowed to contact the scaffold or its suspension system.

(g) *Fall protection.* (1) Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower level. Paragraphs (g)(1) (i) through (vii) of this section establish the types of fall protection to be provided to the employees on each type of scaffold. Paragraph (g)(2) of this section addresses fall protection for scaffold erectors and dismantlers.

Note to paragraph (g)(1): The fall protection requirements for employees installing suspension scaffold support systems on floors, roofs, and other elevated surfaces are set forth in subpart M of this part.

(i) Each employee on a boatswains' chair, catenary scaffold, float scaffold, needle beam scaffold, or ladder jack scaffold shall be protected by a personal fall arrest system;

(ii) Each employee on a single-point or two-point adjustable suspension scaffold shall be protected by both a personal fall arrest system and guardrail system;

(iii) Each employee on a crawling board (chicken ladder) shall be protected by a personal fall arrest system, a guardrail system (with minimum 200 pound toprail capacity), or by a three-fourth inch (1.9 cm) diameter grabline or equivalent handhold securely fastened beside each crawling board;

(iv) Each employee on a self-contained adjustable scaffold shall be

protected by a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by the frame structure, and by both a personal fall arrest system and a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by ropes;

(v) Each employee on a walkway located within a scaffold shall be protected by a guardrail system (with minimum 200 pound toprail capacity) installed within 9½ inches (24.1 cm) of and along at least one side of the walkway.

(vi) Each employee performing overhand bricklaying operations from a supported scaffold shall be protected from falling from all open sides and ends of the scaffold (except at the side next to the wall being laid) by the use of a personal fall arrest system or guardrail system (with minimum 200 pound toprail capacity).

(vii) For all scaffolds not otherwise specified in paragraphs (g)(1)(i) through (g)(1)(vi) of this section, each employee shall be protected by the use of personal fall arrest systems or guardrail systems meeting the requirements of paragraph (g)(4) of this section.

(2) Effective September 2, 1997, the employer shall have a competent person determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. Employers are required to provide fall protection for employees erecting or dismantling supported scaffolds where the installation and use of such protection is feasible and does not create a greater hazard.

(3) In addition to meeting the requirements of § 1926.502(d), personal fall arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member. Vertical lifelines shall not be used when overhead protection or additional platform levels, are part of a single-point or two-point adjustable suspension scaffold.

(i) When vertical lifelines are used, they shall be fastened to a fixed safe point of anchorage, shall be independent of the scaffold, and shall be protected from sharp edges and abrasion. Safe points of anchorage include structural members of buildings, but do not include standpipes, vents, other piping systems, electrical conduit, outrigger beams, or counterweights.

(ii) When horizontal lifelines are used, they shall be secured to two or more structural members of the scaffold, or they may be looped around both suspension and independent

suspension lines (on scaffolds so equipped) above the hoist and brake attached to the end of the scaffold. Horizontal lifelines shall not be attached only to the suspension ropes.

(iii) When lanyards are connected to horizontal lifelines or structural members on a single-point or two-point adjustable suspension scaffold, the scaffold shall be equipped with additional independent support lines and automatic locking devices capable of stopping the fall of the scaffold in the event one or both of the suspension ropes fail. The independent support lines shall be equal in number and strength to the suspension ropes.

(iv) Vertical lifelines, independent support lines, and suspension ropes shall not be attached to each other, nor shall they be attached to or use the same point of anchorage, nor shall they be attached to the same point on the scaffold or personal fall arrest system.

(4) Guardrail systems installed to meet the requirements of this section shall comply with the following provisions (guardrail systems built in accordance with Appendix A to this subpart will be deemed to meet the requirements of paragraphs (g)(4) (vii), (viii), and (ix) of this section):

(i) Guardrail systems shall be installed along all open sides and ends of platforms. Guardrail systems shall be installed before the scaffold is released for use by employees other than erection/dismantling crews.

(ii) The top edge height of toprails or equivalent member on supported scaffolds manufactured or placed in service after January 1, 2000 shall be installed between 38 inches (0.97 m) and 45 inches (1.2 m) above the platform surface. The top edge height on supported scaffolds manufactured and placed in service before January 1, 2000, and on all suspended scaffolds where both a guardrail and a personal fall arrest system are required shall be between 36 inches (0.9 m) and 45 inches (1.2 m). When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of paragraph (g)(4).

(iii) When midrails, screens, mesh, intermediate vertical members, solid panels, or equivalent structural members are used, they shall be installed between the top edge of the guardrail system and the scaffold platform.

(iv) When midrails are used, they shall be installed at a height approximately midway between the top edge of the guardrail system and the platform surface.

(v) When screens and mesh are used, they shall extend from the top edge of the guardrail system to the scaffold platform, and along the entire opening between the supports.

(vi) When intermediate members (such as balusters or additional rails) are used, they shall not be more than 19 inches (48 cm) apart.

(vii) Each toprail or equivalent member of a guardrail system shall be capable of withstanding, without failure, a force applied in any downward or horizontal direction at any point along its top edge of at least 100 pounds (445 n) for guardrail systems installed on single-point adjustable suspension scaffolds or two-point adjustable suspension scaffolds, and at least 200 pounds (890 n) for guardrail systems installed on all other scaffolds.

(viii) When the loads specified in paragraph (g)(4)(vii) of this section are applied in a downward direction, the top edge shall not drop below the height above the platform surface that is prescribed in paragraph (g)(4)(ii) of this section.

(ix) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members of a guardrail system shall be capable of withstanding, without failure, a force applied in any downward or horizontal direction at any point along the midrail or other member of at least 75 pounds (333 n) for guardrail systems with a minimum 100 pound toprail capacity, and at least 150 pounds (666 n) for guardrail systems with a minimum 200 pound toprail capacity.

(x) Suspension scaffold hoists and non-walk-through stirrups may be used as end guardrails, if the space between the hoist or stirrup and the side guardrail or structure does not allow passage of an employee to the end of the scaffold.

(xi) Guardrails shall be surfaced to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

(xii) The ends of all rails shall not overhang the terminal posts except when such overhang does not constitute a projection hazard to employees.

(xiii) Steel or plastic banding shall not be used as a toprail or midrail.

(xiv) Manila or plastic (or other synthetic) rope being used for toprails or midrails shall be inspected by a competent person as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (g) of this section.

(xv) Crossbracing is acceptable in place of a midrail when the crossing point of two braces is between 20 inches

(0.5 m) and 30 inches (0.8 m) above the work platform or as a toprail when the crossing point of two braces is between 38 inches (0.97 m) and 48 inches (1.3 m) above the work platform. The end points at each upright shall be no more than 48 inches (1.3 m) apart.

(h) *Falling object protection.* (1) In addition to wearing hardhats each employee on a scaffold shall be provided with additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects. When the falling objects are too large, heavy or massive to be contained or deflected by any of the above-listed measures, the employer shall place such potential falling objects away from the edge of the surface from which they could fall and shall secure those materials as necessary to prevent their falling.

(2) Where there is a danger of tools, materials, or equipment falling from a scaffold and striking employees below, the following provisions apply:

(i) The area below the scaffold to which objects can fall shall be barricaded, and employees shall not be permitted to enter the hazard area; or

(ii) A toeboard shall be erected along the edge of platforms more than 10 feet (3.1 m) above lower levels for a distance sufficient to protect employees below, except on float (ship) scaffolds where an edging of  $\frac{3}{4} \times 1\frac{1}{2}$  inch (2 x 4 cm) wood or equivalent may be used in lieu of toeboards;

(iii) Where tools, materials, or equipment are piled to a height higher than the top edge of the toeboard, paneling or screening extending from the toeboard or platform to the top of the guardrail shall be erected for a distance sufficient to protect employees below; or

(iv) A guardrail system shall be installed with openings small enough to prevent passage of potential falling objects; or

(v) A canopy structure, debris net, or catch platform strong enough to withstand the impact forces of the potential falling objects shall be erected over the employees below.

(3) Canopies, when used for falling object protection, shall comply with the following criteria:

(i) Canopies shall be installed between the falling object hazard and the employees.

(ii) When canopies are used on suspension scaffolds for falling object protection, the scaffold shall be equipped with additional independent

support lines equal in number to the number of points supported, and equivalent in strength to the strength of the suspension ropes.

(iii) Independent support lines and suspension ropes shall not be attached to the same points of anchorage.

(4) Where used, toeboards shall be:

(i) Capable of withstanding, without failure, a force of at least 50 pounds (222 n) applied in any downward or horizontal direction at any point along the toeboard (toeboards built in accordance with Appendix A to this subpart will be deemed to meet this requirement); and

(ii) At least three and one-half inches (9 cm) high from the top edge of the toeboard to the level of the walking/working surface. Toeboards shall be securely fastened in place at the outermost edge of the platform and have not more than 1/4 inch (0.7 cm) clearance above the walking/working surface. Toeboards shall be solid or with openings not over one inch (2.5 cm) in the greatest dimension.

**§ 1926.452 Additional requirements applicable to specific types of scaffolds.**

In addition to the applicable requirements of § 1926.451, the following requirements apply to the specific types of scaffolds indicated. Scaffolds not specifically addressed by § 1926.452, such as but not limited to systems scaffolds, must meet the requirements of § 1926.451.

(a) *Pole scaffolds.* (1) When platforms are being moved to the next level, the existing platform shall be left undisturbed until the new bearers have been set in place and braced, prior to receiving the new platforms.

(2) Crossbracing shall be installed between the inner and outer sets of poles on double pole scaffolds.

(3) Diagonal bracing in both directions shall be installed across the entire inside face of double-pole scaffolds used to support loads equivalent to a uniformly distributed load of 50 pounds (222 kg) or more per square foot (929 square cm).

(4) Diagonal bracing in both directions shall be installed across the entire outside face of all double- and single-pole scaffolds.

(5) Runners and bearers shall be installed on edge.

(6) Bearers shall extend a minimum of 3 inches (7.6 cm) over the outside edges of runners.

(7) Runners shall extend over a minimum of two poles, and shall be supported by bearing blocks securely attached to the poles.

(8) Braces, bearers, and runners shall not be spliced between poles.

(9) Where wooden poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on at least two adjacent sides, and shall extend at least 2 feet (0.6 m) on either side of the splice, overlap the abutted ends equally, and have at least the same cross-sectional areas as the pole. Splice plates of other materials of equivalent strength may be used.

(10) Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for pole scaffolds under 60 feet in height.

(b) *Tube and coupler scaffolds.* (1) When platforms are being moved to the next level, the existing platform shall be left undisturbed until the new bearers have been set in place and braced prior to receiving the new platforms.

(2) Transverse bracing forming an "X" across the width of the scaffold shall be installed at the scaffold ends and at least at every third set of posts horizontally (measured from only one end) and every fourth runner vertically. Bracing shall extend diagonally from the inner or outer posts or runners upward to the next outer or inner posts or runners. Building ties shall be installed at the bearer levels between the transverse bracing and shall conform to the requirements of § 1926.451(c)(1).

(3) On straight run scaffolds, longitudinal bracing across the inner and outer rows of posts shall be installed diagonally in both directions, and shall extend from the base of the end posts upward to the top of the scaffold at approximately a 45 degree angle. On scaffolds whose length is greater than their height, such bracing shall be repeated beginning at least at every fifth post. On scaffolds whose length is less than their height, such bracing shall be installed from the base of the end posts upward to the opposite end posts, and then in alternating directions until reaching the top of the scaffold. Bracing shall be installed as close as possible to the intersection of the bearer and post or runner and post.

(4) Where conditions preclude the attachment of bracing to posts, bracing shall be attached to the runners as close to the post as possible.

(5) Bearers shall be installed transversely between posts, and when coupled to the posts, shall have the inboard coupler bear directly on the runner coupler. When the bearers are

coupled to the runners, the couplers shall be as close to the posts as possible.

(6) Bearers shall extend beyond the posts and runners, and shall provide full contact with the coupler.

(7) Runners shall be installed along the length of the scaffold, located on both the inside and outside posts at level heights (when tube and coupler guardrails and midrails are used on outside posts, they may be used in lieu of outside runners).

(8) Runners shall be interlocked on straight runs to form continuous lengths, and shall be coupled to each post. The bottom runners and bearers shall be located as close to the base as possible.

(9) Couplers shall be of a structural metal, such as drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

(10) Tube and coupler scaffolds over 125 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for tube and coupler scaffolds under 125 feet in height.

(c) *Fabricated frame scaffolds* (tubular welded frame scaffolds). (1) When moving platforms to the next level, the existing platform shall be left undisturbed until the new end frames have been set in place and braced prior to receiving the new platforms.

(2) Frames and panels shall be braced by cross, horizontal, or diagonal braces, or combination thereof, which secure vertical members together laterally. The cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, level, and square. All brace connections shall be secured.

(3) Frames and panels shall be joined together vertically by coupling or stacking pins or equivalent means.

(4) Where uplift can occur which would displace scaffold end frames or panels, the frames or panels shall be locked together vertically by pins or equivalent means.

(5) Brackets used to support cantilevered loads shall:

(i) Be seated with side-brackets parallel to the frames and end-brackets at 90 degrees to the frames;

(ii) Not be bent or twisted from these positions; and

(iii) Be used only to support personnel, unless the scaffold has been designed for other loads by a qualified

engineer and built to withstand the tipping forces caused by those other loads being placed on the bracket-supported section of the scaffold.

(6) Scaffolds over 125 feet (38.0 m) in height above their base plates shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design.

(d) *Plasterers', decorators', and large area scaffolds.* Scaffolds shall be constructed in accordance with paragraphs (a), (b), or (c) of this section, as appropriate.

(e) *Bricklayers' square scaffolds (squares).* (1) Scaffolds made of wood shall be reinforced with gussets on both sides of each corner.

(2) Diagonal braces shall be installed on all sides of each square.

(3) Diagonal braces shall be installed between squares on the rear and front sides of the scaffold, and shall extend from the bottom of each square to the top of the next square.

(4) Scaffolds shall not exceed three tiers in height, and shall be so constructed and arranged that one square rests directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier, and shall be nailed down or otherwise secured to prevent displacement.

(f) *Horse scaffolds.* (1) Scaffolds shall not be constructed or arranged more than two tiers or 10 feet (3.0 m) in height, whichever is less.

(2) When horses are arranged in tiers, each horse shall be placed directly over the horse in the tier below.

(3) When horses are arranged in tiers, the legs of each horse shall be nailed down or otherwise secured to prevent displacement.

(4) When horses are arranged in tiers, each tier shall be crossbraced.

(g) *Form scaffolds and carpenters' bracket scaffolds.* (1) Each bracket, except those for wooden bracket-form scaffolds, shall be attached to the supporting formwork or structure by means of one or more of the following: nails; a metal stud attachment device; welding; hooking over a secured structural supporting member, with the form wales either bolted to the form or secured by snap ties or tie bolts extending through the form and securely anchored; or, for carpenters' bracket scaffolds only, by a bolt extending through to the opposite side of the structure's wall.

(2) Wooden bracket-form scaffolds shall be an integral part of the form panel.

(3) Folding type metal brackets, when extended for use, shall be either bolted or secured with a locking-type pin.

(h) *Roof bracket scaffolds.* (1) Scaffold brackets shall be constructed to fit the pitch of the roof and shall provide a level support for the platform.

(2) Brackets (including those provided with pointed metal projections) shall be anchored in place by nails unless it is impractical to use nails. When nails are not used, brackets shall be secured in place with first-grade manila rope of at least three-fourth inch (1.9 cm) diameter, or equivalent.

(i) *Outrigger scaffolds.* (1) The inboard end of outrigger beams, measured from the fulcrum point to the extreme point of anchorage, shall be not less than one and one-half times the outboard end in length.

(2) Outrigger beams fabricated in the shape of an I-beam or channel shall be placed so that the web section is vertical.

(3) The fulcrum point of outrigger beams shall rest on secure bearings at least 6 inches (15.2 cm) in each horizontal dimension.

(4) Outrigger beams shall be secured in place against movement, and shall be securely braced at the fulcrum point against tipping.

(5) The inboard ends of outrigger beams shall be securely anchored either by means of braced struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both.

(6) The entire supporting structure shall be securely braced to prevent any horizontal movement.

(7) To prevent their displacement, platform units shall be nailed, bolted, or otherwise secured to outriggers.

(8) Scaffolds and scaffold components shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with such design.

(j) *Pump jack scaffolds.* (1) Pump jack brackets, braces, and accessories shall be fabricated from metal plates and angles. Each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage.

(2) Poles shall be secured to the structure by rigid triangular bracing or equivalent at the bottom, top, and other points as necessary. When the pump jack has to pass bracing already installed, an additional brace shall be installed approximately 4 feet (1.2 m) above the brace to be passed, and shall be left in place until the pump jack has been moved and the original brace reinstalled.

(3) When guardrails are used for fall protection, a workbench may be used as the toprail only if it meets all the

requirements in paragraphs (g)(4) (ii), (vii), (viii), and (xiii) of § 1926.451.

(4) Work benches shall not be used as scaffold platforms.

(5) When poles are made of wood, the pole lumber shall be straight-grained, free of shakes, large loose or dead knots, and other defects which might impair strength.

(6) When wood poles are constructed of two continuous lengths, they shall be joined together with the seam parallel to the bracket.

(7) When two by fours are spliced to make a pole, mending plates shall be installed at all splices to develop the full strength of the member.

(k) *Ladder jack scaffolds.* (1) Platforms shall not exceed a height of 20 feet (6.1 m).

(2) All ladders used to support ladder jack scaffolds shall meet the requirements of subpart X of this part—Stairways and Ladders, except that job-made ladders shall not be used to support ladder jack scaffolds.

(3) The ladder jack shall be so designed and constructed that it will bear on the side rails and ladder rungs or on the ladder rungs alone. If bearing on rungs only, the bearing area shall include a length of at least 10 inches (25.4 cm) on each rung.

(4) Ladders used to support ladder jacks shall be placed, fastened, or equipped with devices to prevent slipping.

(5) Scaffold platforms shall not be bridged one to another.

(l) *Window jack scaffolds.* (1) Scaffolds shall be securely attached to the window opening.

(2) Scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(3) Window jacks shall not be used to support planks placed between one window jack and another, or for other elements of scaffolding.

(m) *Crawling boards (chicken ladders).* (1) Crawling boards shall extend from the roof peak to the eaves when used in connection with roof construction, repair, or maintenance.

(2) Crawling boards shall be secured to the roof by ridge hooks or by means that meet equivalent criteria (e.g., strength and durability).

(n) *Step, platform, and trestle ladder scaffolds.* (1) Scaffold platforms shall not be placed any higher than the second highest rung or step of the ladder supporting the platform.

(2) All ladders used in conjunction with step, platform and trestle ladder scaffolds shall meet the pertinent requirements of subpart X of this part—Stairways and Ladders, except that job-



made ladders shall not be used to support such scaffolds.

(3) Ladders used to support step, platform, and trestle ladder scaffolds shall be placed, fastened, or equipped with devices to prevent slipping.

(4) Scaffolds shall not be bridged one to another.

(o) *Single-point adjustable suspension scaffolds.* (1) When two single-point adjustable suspension scaffolds are combined to form a two-point adjustable suspension scaffold, the resulting two-point scaffold shall comply with the requirements for two-point adjustable suspension scaffolds in paragraph (p) of this section.

(2) The supporting rope between the scaffold and the suspension device shall be kept vertical unless all of the following conditions are met:

(i) The rigging has been designed by a qualified person, and

(ii) The scaffold is accessible to rescuers, and

(iii) The supporting rope is protected to ensure that it will not chafe at any point where a change in direction occurs, and

(iv) The scaffold is positioned so that swinging cannot bring the scaffold into contact with another surface.

(3) Boatswains' chair tackle shall consist of correct size ball bearings or bushed blocks containing safety hooks and properly "eye-spliced" minimum five-eighth ( $\frac{5}{8}$ ) inch (1.6 cm) diameter first-grade manila rope, or other rope which will satisfy the criteria (e.g., strength and durability) of manila rope.

(4) Boatswains' chair seat slings shall be reeved through four corner holes in the seat; shall cross each other on the underside of the seat; and shall be rigged so as to prevent slippage which could cause an out-of-level condition.

(5) Boatswains' chair seat slings shall be a minimum of five-eighth ( $\frac{5}{8}$ ) inch (1.6 cm) diameter fiber, synthetic, or other rope which will satisfy the criteria (e.g., strength, slip resistance, durability, etc.) of first grade manila rope.

(6) When a heat-producing process such as gas or arc welding is being conducted, boatswains' chair seat slings shall be a minimum of three-eighth ( $\frac{3}{8}$ ) inch (1.0 cm) wire rope.

(7) Non-cross-laminated wood boatswains' chairs shall be reinforced on their underside by cleats securely fastened to prevent the board from splitting.

(p) *Two-point adjustable suspension scaffolds (swing stages).* The following requirements do not apply to two-point adjustable suspension scaffolds used as masons' or stonemasons' scaffolds. Such scaffolds are covered by paragraph (q) of this section.

(1) Platforms shall not be more than 36 inches (0.9 m) wide unless designed by a qualified person to prevent unstable conditions.

(2) The platform shall be securely fastened to hangers (stirrups) by U-bolts or by other means which satisfy the requirements of § 1926.451(a).

(3) The blocks for fiber or synthetic ropes shall consist of at least one double and one single block. The sheaves of all blocks shall fit the size of the rope used.

(4) Platforms shall be of the ladder-type, plank-type, beam-type, or light-metal type. Light metal-type platforms having a rated capacity of 750 pounds or less and platforms 40 feet (12.2 m) or less in length shall be tested and listed by a nationally recognized testing laboratory.

(5) Two-point scaffolds shall not be bridged or otherwise connected one to another during raising and lowering operations unless the bridge connections are articulated (attached), and the hoists properly sized.

(6) Passage may be made from one platform to another only when the platforms are at the same height, are abutting, and walk-through stirrups specifically designed for this purpose are used.

(q) *Multi-point adjustable suspension scaffolds, stonemasons' multi-point adjustable suspension scaffolds, and masons' multi-point adjustable suspension scaffolds.* (1) When two or more scaffolds are used they shall not be bridged one to another unless they are designed to be bridged, the bridge connections are articulated, and the hoists are properly sized.

(2) If bridges are not used, passage may be made from one platform to another only when the platforms are at the same height and are abutting.

(3) Scaffolds shall be suspended from metal outriggers, brackets, wire rope slings, hooks, or means that meet equivalent criteria (e.g., strength, durability).

(r) *Catenary scaffolds.* (1) No more than one platform shall be placed between consecutive vertical pickups, and no more than two platforms shall be used on a catenary scaffold.

(2) Platforms supported by wire ropes shall have hook-shaped stops on each end of the platforms to prevent them from slipping off the wire ropes. These hooks shall be so placed that they will prevent the platform from falling if one of the horizontal wire ropes breaks.

(3) Wire ropes shall not be tightened to the extent that the application of a scaffold load will overstress them.

(4) Wire ropes shall be continuous and without splices between anchors.

(s) *Float (ship) scaffolds.* (1) The platform shall be supported by a minimum of two bearers, each of which shall project a minimum of 6 inches (15.2 cm) beyond the platform on both sides. Each bearer shall be securely fastened to the platform.

(2) Rope connections shall be such that the platform cannot shift or slip.

(3) When only two ropes are used with each float:

(i) They shall be arranged so as to provide four ends which are securely fastened to overhead supports.

(ii) Each supporting rope shall be hitched around one end of the bearer and pass under the platform to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

(t) *Interior hung scaffolds.* (1) Scaffolds shall be suspended only from the roof structure or other structural member such as ceiling beams.

(2) Overhead supporting members (roof structure, ceiling beams, or other structural members) shall be inspected and checked for strength before the scaffold is erected.

(3) Suspension ropes and cables shall be connected to the overhead supporting members by shackles, clips, thimbles, or other means that meet equivalent criteria (e.g., strength, durability).

(u) *Needle beam scaffolds.* (1) Scaffold support beams shall be installed on edge.

(2) Ropes or hangers shall be used for supports, except that one end of a needle beam scaffold may be supported by a permanent structural member.

(3) The ropes shall be securely attached to the needle beams.

(4) The support connection shall be arranged so as to prevent the needle beam from rolling or becoming displaced.

(5) Platform units shall be securely attached to the needle beams by bolts or equivalent means. Cleats and overhang are not considered to be adequate means of attachment.

(v) *Multi-level suspended scaffolds.*

(1) Scaffolds shall be equipped with additional independent support lines, equal in number to the number of points supported, and of equivalent strength to the suspension ropes, and rigged to support the scaffold in the event the suspension rope(s) fail.

(2) Independent support lines and suspension ropes shall not be attached to the same points of anchorage.

(3) Supports for platforms shall be attached directly to the support stirrup and not to any other platform.

(w) *Mobile scaffolds.* (1) Scaffolds shall be braced by cross, horizontal, or



diagonal braces, or combination thereof, to prevent racking or collapse of the scaffold and to secure vertical members together laterally so as to automatically square and align the vertical members. Scaffolds shall be plumb, level, and squared. All brace connections shall be secured.

(i) Scaffolds constructed of tube and coupler components shall also comply with the requirements of paragraph (b) of this section;

(ii) Scaffolds constructed of fabricated frame components shall also comply with the requirements of paragraph (c) of this section.

(2) Scaffold casters and wheels shall be locked with positive wheel and/or wheel and swivel locks, or equivalent means, to prevent movement of the scaffold while the scaffold is used in a stationary manner.

(3) Manual force used to move the scaffold shall be applied as close to the base as practicable, but not more than 5 feet (1.5 m) above the supporting surface.

(4) Power systems used to propel mobile scaffolds shall be designed for such use. Forklifts, trucks, similar motor vehicles or add-on motors shall not be used to propel scaffolds unless the scaffold is designed for such propulsion systems.

(5) Scaffolds shall be stabilized to prevent tipping during movement.

(6) Employees shall not be allowed to ride on scaffolds unless the following conditions exist:

(i) The surface on which the scaffold is being moved is within 3 degrees of level, and free of pits, holes, and obstructions;

(ii) The height to base width ratio of the scaffold during movement is two to one or less, unless the scaffold is designed and constructed to meet or exceed nationally recognized stability test requirements such as those listed in paragraph (x) of Appendix A to this subpart (ANSI/SIA A92.5 and A92.6);

(iii) Outrigger frames, when used, are installed on both sides of the scaffold;

(iv) When power systems are used, the propelling force is applied directly to the wheels, and does not produce a speed in excess of 1 foot per second (.3 mps); and

(v) No employee is on any part of the scaffold which extends outward beyond the wheels, casters, or other supports.

(7) Platforms shall not extend outward beyond the base supports of the scaffold unless outrigger frames or equivalent devices are used to ensure stability.

(8) Where leveling of the scaffold is necessary, screw jacks or equivalent means shall be used.

(9) Caster stems and wheel stems shall be pinned or otherwise secured in scaffold legs or adjustment screws.

(10) Before a scaffold is moved, each employee on the scaffold shall be made aware of the move.

(x) *Repair bracket scaffolds.* (1) Brackets shall be secured in place by at least one wire rope at least 1/2 inch (1.27 cm) in diameter.

(2) Each bracket shall be attached to the securing wire rope (or ropes) by a positive locking device capable of preventing the unintentional detachment of the bracket from the rope, or by equivalent means.

(3) Each bracket, at the contact point between the supporting structure and the bottom of the bracket, shall be provided with a shoe (heel block or foot) capable of preventing the lateral movement of the bracket.

(4) Platforms shall be secured to the brackets in a manner that will prevent the separation of the platforms from the brackets and the movement of the platforms or the brackets on a completed scaffold.

(5) When a wire rope is placed around the structure in order to provide a safe anchorage for personal fall arrest systems used by employees erecting or dismantling scaffolds, the wire rope shall meet the requirements of subpart M of this part, but shall be at least 5/16 inch (0.8 cm) in diameter.

(6) Each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems shall be protected from damage due to contact with edges, corners, protrusions, or other discontinuities of the supporting structure or scaffold components.

(7) Tensioning of each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems shall be by means of a turnbuckle at least 1 inch (2.54 cm) in diameter, or by equivalent means.

(8) Each turnbuckle shall be connected to the other end of its rope by use of an eyesplice thimble of a size appropriate to the turnbuckle to which it is attached.

(9) U-bolt wire rope clips shall not be used on any wire rope used to secure brackets or to serve as an anchor for personal fall arrest systems.

(10) The employer shall ensure that materials shall not be dropped to the outside of the supporting structure.

(11) Scaffold erection shall progress in only one direction around any structure.

(y) *Stilts.* Stilts, when used, shall be used in accordance with the following requirements:

(1) An employee may wear stilts on a scaffold only if it is a large area scaffold.

(2) When an employee is using stilts on a large area scaffold where a guardrail system is used to provide fall protection, the guardrail system shall be increased in height by an amount equal to the height of the stilts being used by the employee.

(3) Surfaces on which stilts are used shall be flat and free of pits, holes and obstructions, such as debris, as well as other tripping and falling hazards.

(4) Stilts shall be properly maintained. Any alteration of the original equipment shall be approved by the manufacturer.

#### § 1926.453 Aerial lifts.

(a) *General requirements.* (1) Unless otherwise provided in this section, aerial lifts acquired for use on or after January 22, 1973 shall be designed and constructed in conformance with the applicable requirements of the American National Standards for "Vehicle Mounted Elevating and Rotating Work Platforms," ANSI A92.2-1969, including appendix. Aerial lifts acquired before January 22, 1973 which do not meet the requirements of ANSI A92.2-1969, may not be used after January 1, 1976, unless they shall have been modified so as to conform with the applicable design and construction requirements of ANSI A92.2-1969. Aerial lifts include the following types of vehicle-mounted aerial devices used to elevate personnel to job-sites above ground:

(i) Extensible boom platforms;  
(ii) Aerial ladders;  
(iii) Articulating boom platforms;  
(iv) Vertical towers; and  
(v) A combination of any such devices. Aerial equipment may be made of metal, wood, fiberglass reinforced plastic (FRP), or other material; may be powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

(2) Aerial lifts may be "field modified" for uses other than those intended by the manufacturer provided the modification has been certified in writing by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory, to be in conformity with all applicable provisions of ANSI A92.2-1969 and this section and to be at least as safe as the equipment was before modification.

(b) *Specific requirements.* (1) *Ladder trucks and tower trucks.* Aerial ladders shall be secured in the lower traveling position by the locking device on top of the truck cab, and the manually operated device at the base of the ladder before the truck is moved for highway travel.

(2) *Extensible and articulating boom platforms.* (i) Lift controls shall be tested each day prior to use to determine that such controls are in safe working condition.

(ii) Only authorized persons shall operate an aerial lift.

(iii) Belting off to an adjacent pole, structure, or equipment while working from an aerial lift shall not be permitted.

(iv) Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

(v) A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift.

(vi) Boom and basket load limits specified by the manufacturer shall not be exceeded.

(vii) The brakes shall be set and when outriggers are used, they shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline, provided they can be safely installed.

(viii) An aerial lift truck shall not be moved when the boom is elevated in a working position with men in the basket, except for equipment which is specifically designed for this type of operation in accordance with the provisions of paragraphs (a) (1) and (2) of this section.

(ix) Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

(x) Climbers shall not be worn while performing work from an aerial lift.

(xi) The insulated portion of an aerial lift shall not be altered in any manner that might reduce its insulating value.

(xii) Before moving an aerial lift for travel, the boom(s) shall be inspected to see that it is properly cradled and outriggers are in stowed position except as provided in paragraph (b)(2)(viii) of this section.

(3) *Electrical tests.* All electrical tests shall conform to the requirements of ANSI A92.2-1969 section 5. However equivalent d.c.; voltage tests may be used in lieu of the a.c. voltage specified in A92.2-1969; d.c. voltage tests which are approved by the equipment manufacturer or equivalent entity shall be considered an equivalent test for the purpose of this paragraph (b)(3).

(4) *Bursting safety factor.* The provisions of the American National Standards Institute standard ANSI A92.2-1969, section 4.9 Bursting Safety Factor shall apply to all critical hydraulic and pneumatic components. Critical components are those in which a failure would result in a free fall or free rotation of the boom. All noncritical components shall have a bursting safety factor of at least 2 to 1.

(5) *Welding standards.* All welding shall conform to the following standards as applicable:

(i) Standard Qualification Procedure, AWS B3.0-41.

(ii) Recommended Practices for Automotive Welding Design, AWS D8.4-61.

(iii) Standard Qualification of Welding Procedures and Welders for Piping and Tubing, AWS D10.9-69.

(iv) Specifications for Welding Highway and Railway Bridges, AWS D2.0-69.

Note to § 1926.453: Non-mandatory Appendix C to this subpart lists examples of national consensus standards that are considered to provide employee protection equivalent to that provided through the application of ANSI A92.2-1969, where appropriate. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from the American National Standards Institute. Copies may be inspected at the Docket Office, Occupational Safety and Health Administration, U.S. Department of Labor, 200 Constitution Avenue, NW., room N2634, Washington, DC or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

#### **§ 1926.454 Training requirements.**

This section supplements and clarifies the requirements of § 1926.21(b)(2) as these relate to the hazards of work on scaffolds.

(a) The employer shall have each employee who performs work while on a scaffold trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. The training shall include the following areas, as applicable:

(1) The nature of any electrical hazards, fall hazards and falling object hazards in the work area;

(2) The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems being used;

(3) The proper use of the scaffold, and the proper handling of materials on the scaffold;

(4) The maximum intended load and the load-carrying capacities of the scaffolds used; and

(5) Any other pertinent requirements of this subpart.

(b) The employer shall have each employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold trained by a competent person to recognize any hazards associated with the work in question. The training shall include the following topics, as applicable:

(1) The nature of scaffold hazards;

(2) The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question;

(3) The design criteria, maximum intended load-carrying capacity and intended use of the scaffold;

(4) Any other pertinent requirements of this subpart.

(c) When the employer has reason to believe that an employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, the employer shall retrain each such employee so that the requisite proficiency is regained. Retraining is required in at least the following situations:

(1) Where changes at the worksite present a hazard about which an employee has not been previously trained; or

(2) Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained; or

(3) Where inadequacies in an affected employee's work involving scaffolds indicate that the employee has not retained the requisite proficiency.

#### **Non-Mandatory Appendices**

(Non-mandatory) Appendix A to Subpart L—Scaffold Specifications

This Appendix provides non-mandatory guidelines to assist employers in complying with the requirements of subpart L of this part. An employer may use these guidelines and tables as a starting point for designing scaffold systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of § 1926.451(a). Scaffold components which are not selected and loaded in accordance with this Appendix, and components for which no specific guidelines or tables are given in this Appendix (e.g., joints, ties, components for wood pole scaffolds more than 60 feet in height, components for heavy-duty horse

scaffolds, components made with other materials, and components with other dimensions, etc.) must be designed and constructed in accordance with the capacity requirements of § 1926.451(a), and loaded in accordance with § 1926.451(d)(1).

#### Index to Appendix A for Subpart L

1. General guidelines and tables.
2. Specific guidelines and tables.
  - (a) Pole scaffolds:
    - Single-pole wood pole scaffolds.
    - Independent wood pole scaffolds.
  - (b) Tube and coupler scaffolds.
  - (c) Fabricated frame scaffolds.
  - (d) Plasterers', decorators' and large area scaffolds.
  - (e) Bricklayers' square scaffolds.
  - (f) Horse scaffolds.
  - (g) Form scaffolds and carpenters' bracket scaffolds.
  - (h) Roof bracket scaffolds.
  - (i) Outrigger scaffolds (one level).
  - (j) Pump jack scaffolds.
  - (k) Ladder jack scaffolds.
  - (l) Window jack scaffolds.
  - (m) Crawling boards (chicken ladders).
  - (n) Step, platform and trestle ladder scaffolds.
  - (o) Single-point adjustable suspension scaffolds.
  - (p) Two-point adjustable suspension scaffolds.
  - (q)(1) Stonesetters' multi-point adjustable suspension scaffolds.

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- (r) Catenary scaffolds.
- (s) Float (ship) scaffolds.
- (t) Interior hung scaffolds.
- (u) Needle beam scaffolds.
- (v) Multi-level suspension scaffolds.
- (w) Mobile scaffolds.
- (x) Repair bracket scaffolds.
- (y) Stilts.
- (z) Tank builders' scaffolds.

#### 1. General Guidelines and Tables

(a) The following tables, and the tables in Part 2—Specific guidelines and tables, assume that all load-carrying timber members (except planks) of the scaffold are a minimum of 1,500 lb-ft/in<sup>2</sup> (stress grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Softwood Lumber Standards, dated January 1970, except that, where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements.

(b) Solid sawn wood used as scaffold planks shall be selected for such use following the grading rules established by a recognized lumber grading association or by an independent lumber grading inspection agency. Such planks shall be identified by the grade stamp of such association or agency. The association or agency and the grading rules under which the wood is graded shall be certified by the Board of Review, American Lumber Standard Committee, as set forth in the American

Softwood Lumber Standard of the U.S. Department of Commerce.

(i) Allowable spans shall be determined in compliance with the National Design Specification for Wood Construction published by the National Forest Products Association; paragraph 5 of ANSI A10.8—1988 Scaffolding-Safety Requirements published by the American National Standards Institute; or for 2 x 10 inch (nominal) or 2 x 9 inch (rough) solid sawn wood planks, as shown in the following table:

Maximum intended nominal load (lb/ft <sup>2</sup> )	Maximum permissible span using full thickness undressed lumber (ft)	Maximum permissible span using nominal thickness lumber (ft)
25 .....	10	8
50 .....	8	6
75 .....	6	

(ii) The maximum permissible span for 1 1/4 x 9-inch or wider wood plank of full thickness with a maximum intended load of 50 lb/ft<sup>2</sup> shall be 4 feet.

(c) Fabricated planks and platforms may be used in lieu of solid sawn wood planks. Maximum spans for such units shall be as recommended by the manufacturer based on the maximum intended load being calculated as follows:

Rated load capacity	Intended load
Light-duty .....	• 25 pounds per square foot applied uniformly over the entire span area.
Medium-duty .....	• 50 pounds per square foot applied uniformly over the entire span area.
Heavy-duty .....	• 75 pounds per square foot applied uniformly over the entire span area.
One-person .....	• 250 pounds placed at the center of the span (total 250 pounds).
Two-person .....	• 250 pounds placed 18 inches to the left and right of the center of the span (total 500 pounds).
Three-person .....	• 250 pounds placed at the center of the span and 250 pounds placed 18 inches to the left and right of the center of the span (total 750 pounds).

Note: Platform units used to make scaffold platforms intended for light-duty use shall be capable of supporting at least 25 pounds per square foot applied uniformly over the entire unit-span area, or a 250-pound point load placed on the unit at the center of the span, whichever load produces the greater shear force.

- (d) Guardrails shall be as follows:
- (i) Toprails shall be equivalent in strength to 2 inch by 4 inch lumber; or
  - 1 1/4 inch x 1/8 inch structural angle iron; or
  - 1 inch x .070 inch wall steel tubing; or
  - 1.990 inch x .058 inch wall aluminum tubing.

(ii) Midrails shall be equivalent in strength to 1 inch by 6 inch lumber; or  
 1 1/4 inch x 1 1/4 inch x 1/8 inch structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(iii) Toeboards shall be equivalent in strength to 1 inch by 4 inch lumber; or  
 1 1/4 inch x 1 1/4 inch structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(iv) Posts shall be equivalent in strength to 2 inch by 4 inch lumber; or

1 1/4 inch x 1 1/4 inch x 1/8 structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(v) Distance between posts shall not exceed 8 feet.

(e) Overhead protection shall consist of 2 inch nominal planking laid tight, or 3/4-inch plywood.

(f) Screen installed between toeboards and midrails or top rails shall consist of No. 18 gauge U.S. Standard wire one inch mesh.

#### 2. Specific guidelines and tables.

- (a) Pole Scaffolds.

#### SINGLE POLE WOOD POLE SCAFFOLDS

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load (lbs/ft <sup>2</sup> ) .....	25 .....	25 .....	50 .....	75
Poles or uprights .....	2x4 in .....	4x4 in .....	4x4 in .....	4x6 in.
Maximum pole spacing (longitudinal) .....	6 feet .....	10 feet .....	8 feet .....	6 feet
Maximum pole spacing (transverse) .....	5 feet .....	5 feet .....	5 feet .....	5 feet

## SINGLE POLE WOOD POLE SCAFFOLDS—Continued

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Runners .....	1×4 in .....	1¼×9 in .....	2×10 in .....	2×10 in.
Bearers and maximum spacing of bearers:				
3 feet .....	2×4 in .....	2×4 in .....	2×10 in. or 3×4 in .....	2×10 in. or 3×5 in.
5 feet .....	2×6 in. or 3×4 in .....	2×6 in. or 3×4 in. (rough).	2×10 in. or 3×4 in .....	2×10 in. or 3×5 in.
6 feet .....	.....	.....	2×10 in. or 3×4 in .....	2×10 in. or 3×5 in.
8 feet .....	.....	.....	2×10 in. or 3×4 in .....	.....
Planking .....	1¼×9 in .....	2×10 in .....	2×10 in .....	2×10 in.
Maximum vertical spacing of horizontal members.	7 feet .....	9 feet .....	7 feet .....	6 ft. 6 in.
Bracing horizontal .....	1×4 in .....	1×4 in .....	1×6 in. or 1¼×4 in ....	2×4 in.
Bracing diagonal .....	1×4 in .....	1×4 in .....	1×4 in .....	2×4 in.
Tie-ins .....	1×4 in .....	1×4 in .....	1×4 in .....	1×4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with ¾×2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

## INDEPENDENT WOOD POLE SCAFFOLDS

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load .....	25 lbs/ft² .....	25 lbs/ft² .....	50 lbs/ft² .....	75 lbs/ft².
Poles or uprights .....	2×4 in .....	4×4 in .....	4×4 in .....	4×4 in.
Maximum pole spacing (longitudinal) .....	6 feet .....	10 feet .....	8 feet .....	6 feet.
Maximum (transverse) .....	6 feet .....	10 feet .....	8 feet .....	8 feet.
Runners .....	1¼×4 in .....	1¼×9 in .....	2×10 in .....	2×10 in.
Bearers and maximum spacing of bearers:				
3 feet .....	2×4 in .....	2×4 in .....	2×10 in .....	2×10 in. (rough).
6 feet .....	2×6 in. or 3×4 in .....	2×10 in. (rough) or 3×8 in.	2×10 in .....	2×10 in. (rough).
8 feet .....	2×6 in. or 3×4 in .....	2×10 in. (rough) or 3×8 in.	2×10 in .....	.....
10 feet .....	2×6 in. or 3×4 in .....	2×10 in.— (rough) or 3×3 in.	.....	.....
Planking .....	1¼×9 in .....	2×10 in .....	2×10 in .....	2×10 in.
Maximum vertical spacing of horizontal members.	7 feet .....	7 feet .....	6 feet .....	6 feet.
Bracing horizontal .....	1×4 in .....	1×4 in .....	1×6 in. or 1¼×4 in ....	2×4 in.
Bracing diagonal .....	1×4 in .....	1×4 in .....	1×4 in .....	2×4 in.
Tie-ins .....	1×4 in .....	1×4 in .....	1×4 in .....	1×4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with ¾×2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

(b) Tube and coupler scaffolds.

## MINIMUM SIZE OF MEMBERS

	Light duty	Medium duty	Heavy duty
Maximum intended load .....	25 lbs/ft² .....	50 lbs/ft² .....	75 lbs/ft².
Posts, runners and braces .....	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.
Bearers .....	Nominal 2 in. (1.90 inches) OD steel tube or pipe and a maximum post spacing of 4 ft.×10 ft..	Nominal 2 in. (1.90 inches) OD steel tube or pipe and a maximum post spacing of 4 ft.×7 ft. or. Nominal 2½ in. (2.375 in.). OD steel tube or pipe and a maximum post spacing of 6 ft.×8 ft.*.	Nominal 2½ in. (2.375 in.). OD steel tube or pipe and a maximum post spacing of 6 ft.×6 ft.
Maximum runner spacing vertically	6 ft. 6 in .....	6 ft. 6 in .....	6 ft. 6 in.

\* Bearers shall be installed in the direction of the shorter dimension.

Note: Longitudinal diagonal bracing shall be installed at an angle of 45° (±5°).

## MAXIMUM NUMBER OF PLANKED LEVELS

	Maximum number of additional planked levels			Maximum height of scaffold (in feet)
	Light duty	Medium duty	Heavy duty	
Number of Working Levels:				
1 .....	16	11	6	125
2 .....	11	1	0	125
3 .....	6	0	0	125
4 .....	1	0	0	125

(c) *Fabricated frame scaffolds.* Because of their prefabricated nature, no additional guidelines or tables for these scaffolds are being adopted in this Appendix.

(d) *Plasterers', decorators', and large area scaffolds.* The guidelines for pole scaffolds or tube and coupler scaffolds (Appendix A (a) and (b)) may be applied.

(e) *Bricklayers' square scaffolds.*

Maximum intended load: 50 lb/ft.<sup>2\*</sup>

Maximum width: 5 ft.

Maximum height: 5 ft.

Gussets: 1 × 6 in.

Braces: 1 × 8 in.

Legs: 2 × 6 in.

Bearers (horizontal members): 2 × 6 in.

(f) *Horse scaffolds.*

Maximum intended load (light duty): 25 lb/ft.<sup>2\*\*</sup>

Maximum intended load (medium duty): 50 lb/ft.<sup>2\*\*</sup>

Horizontal members or bearers:

Light duty: 2 × 4 in.

Medium duty: 3 × 4 in.

Legs: 2 × 4 in.

Longitudinal brace between legs: 1 × 6 in.

Gusset brace at top of legs: 1 × 8 in.

Half diagonal braces: 2 × 4 in.

(g) *Form scaffolds and carpenters' bracket scaffolds.*

(1) Brackets shall consist of a triangular-shaped frame made of wood with a cross-section not less than 2 inches by 3 inches, or of 1 1/4 inch × 1 1/4 inch × 1/8 inch structural angle iron.

(2) Bolts used to attach brackets to structures shall not be less than 5/8 inches in diameter.

(3) Maximum bracket spacing shall be 8 feet on centers.

(4) No more than two employees shall occupy any given 8 feet of a bracket or form scaffold at any one time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(5) *Wooden figure-four scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 × 4 in. or 2 × 6 in.

Bearers (two): 1 × 6 in.

Braces: 1 × 6 in.

Maximum length of bearers (unsupported): 3 ft. 6 in.

(i) Outrigger bearers shall consist of two pieces of 1 × 6 inch lumber nailed on opposite sides of the vertical support.

(ii) Bearers for wood figure-four brackets shall project not more than 3 feet 6 inches from the outside of the form support, and shall be braced and secured to prevent tipping or turning. The knee or angle brace shall intersect the bearer at least 3 feet from the form at an angle of approximately 45 degrees, and the lower end shall be nailed to a vertical support.

(6) *Metal bracket scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 × 4 inch

Bearers: As designed.

Braces: As designed.

(7) *Wood bracket scaffolds:*

Maximum intended load: 25 lb/ft.<sup>2</sup>

Uprights: 2 × 4 in or 2 × 6 in

Bearers: 2 × 6 in

Maximum scaffold width: 3 ft 6 in

Braces: 1 × 6 in

(h) *Roof bracket scaffolds.* No specific guidelines or tables are given.

(i) *Outrigger scaffolds (single level).* No specific guidelines or tables are given.

(j) *Pump jack scaffolds.* Wood poles shall not exceed 30 feet in height. Maximum intended load—500 lbs between poles; applied at the center of the span. Not more than two employees shall be on a pump jack scaffold at one time between any two supports. When 2 × 4's are spliced together to make a 4 × 4 inch wood pole, they shall be spliced with "10 penny" common nails no more than 12 inches center to center, staggered uniformly from the opposite outside edges.

(k) *Ladder jack scaffolds.* Maximum intended load—25 lb/ft.<sup>2</sup>. However, not more than two employees shall occupy any platform at any one time. Maximum span between supports shall be 8 feet.

(l) *Window jack scaffolds.* Not more than one employee shall occupy a window jack scaffold at any one time.

(m) *Crawling boards (chicken ladders).* Crawling boards shall be not less than 10

inches wide and 1 inch thick, with cleats having a minimum 1 × 1 1/2 inch cross-sectional area. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches.

(n) *Step, platform, and trestle ladder scaffolds.* No additional guidelines or tables are given.

(o) *Single-point adjustable suspension scaffolds.* Maximum intended load—250 lbs. Wood seats for boatswains' chairs shall be not less than 1 inch thick if made of non-laminated wood, or 5/8 inches thick if made of marine quality plywood.

(p) *Two-point adjustable suspension scaffolds.* (1) In addition to direct connections to buildings (except window cleaners' anchors) acceptable ways to prevent scaffold sway include angulated roping and static lines. Angulated roping is a system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building. Static lines are separate ropes secured at their top and bottom ends closer to the plane of the building face than the outermost edge of the platform. By drawing the static line taut, the platform is drawn against the face of the building.

(2) On suspension scaffolds designed for a working load of 500 pounds, no more than two employees shall be permitted on the scaffold at one time. On suspension scaffolds with a working load of 750 pounds, no more than three employees shall be permitted on the scaffold at one time.

(3) *Ladder-type platforms.* The side stringer shall be of clear straight-grained spruce. The rungs shall be of straight-grained oak, ash, or hickory, at least 1 1/8 inches in diameter, with 7/8 inch tenons mortised into the side stringers at least 7/8 inch. The stringers shall be tied together with tie rods not less than 1/4 inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than 5/8 inch apart, except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with the following table:

\* The squares shall be set not more than 8 feet apart for light duty scaffolds and not more than 5 feet apart for medium duty scaffolds.

\*\* Horses shall be spaced not more than 8 feet apart for light duty loads, and not more than 5 feet apart for medium duty loads.

## SCHEDULE FOR LADDER-TYPE PLATFORMS

Length of Platform .....	12 feet .....	14 & 16 feet .....	18 & 20 feet.
Side stringers, minimum cross section (finished sizes):			
At ends .....	1¾ × 2¾ in .....	1¾ × 2¾ in .....	1¾ × 3 in.
At middle .....	1¾ × 3¾ in .....	1¾ × 3¾ in .....	1¾ × 4 in.
Reinforcing strip (minimum) .....	A 1/8 × 7/8 inch steel reinforcing strip shall be attached to the side or underside, full length.		
Rungs .....	Rungs shall be 1 1/8 inch minimum diameter with at least 7/8 inch in diameter tenons, and the maximum spacing shall be 12 inches to center.		
Tie rods:			
Number (minimum) .....	3 .....	4 .....	4
Diameter (minimum) .....	1/4 inch .....	1/4 inch .....	1/4 inch
Flooring, minimum finished size .....	1/2 × 2¾ in .....	1/2 × 2¾ in .....	1/2 × 2¾ in.

## SCHEDULE FOR LADDER-TYPE PLATFORMS

Length of Platform .....	22 & 24 ft .....	28 & 30 ft.
Side stringers, minimum cross section (finished sizes):		
At ends .....	1¾×3 in .....	1¾ × 3 1/2 in.
At middle .....	1¾ × 4 1/4 in .....	1¾ × 5 in.
Reinforcing strip (minimum) .....	A 1/8 × 7/8-inch steel reinforcing strip shall be attached to the side or underside, full length.	
Rungs .....	Rungs shall be 1 1/8 inch minimum diameter with at least 7/8 inch in diameter tenons, and the maximum spacing shall be 12 inches to center. Tie rods.	
Number (minimum) .....	5 .....	6.
Diameter (minimum) .....	1/4 in .....	1/4 in.
Flooring, minimum finished size .....	1/2 × 2¾ in .....	1/2 × 2¾ in.

(4) Plank-Type Platforms. Plank-type platforms shall be composed of not less than nominal 2 × 8 inch unspliced planks, connected together on the underside with cleats at intervals not exceeding 4 feet, starting 6 inches from each end. A bar or other effective means shall be securely fastened to the platform at each end to prevent the platform from slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 10 feet.

(5) Beam-Type Platforms. Beam platforms shall have side stringers of lumber not less than 2 × 6 inches set on edge. The span between hangers shall not exceed 12 feet when beam platforms are used. The flooring shall be supported on 2 × 6 inch cross beams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than 4 feet, securely nailed to the cross beams. Floor-boards shall not be spaced more than 1/2 inch apart.

(q)(1) *Multi-point adjustable suspension scaffolds and stonemasons' multi-point adjustable suspension scaffolds.* No specific guidelines or tables are given for these scaffolds.

(q)(2) *Masons' multi-point adjustable suspension scaffolds.* Maximum intended load—50 lb/ft<sup>2</sup>. Each outrigger beam shall be at least a standard 7 inch, 15.3 pound steel I-beam, at least 15 feet long. Such beams shall not project more than 6 feet 6 inches beyond the bearing point. Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams.

(r) *Catenary scaffolds.* (1) Maximum intended load—500 lbs.

(2) Not more than two employees shall be permitted on the scaffold at one time.

(3) Maximum capacity of come-along shall be 2,000 lbs.

(4) Vertical pickups shall be spaced not more than 50 feet apart.

(5) Ropes shall be equivalent in strength to at least 1/2 inch (1.3 cm) diameter improved plow steel wire rope.

(s) *Float (ship) scaffolds.* (1) Maximum intended load—750 lbs.

(2) Platforms shall be made of 3/4 inch plywood, equivalent in rating to American Plywood Association Grade B-B, Group I, Exterior.

(3) Bearers shall be made from 2×4 inch, or 1×10 inch rough lumber. They shall be free of knots and other flaws.

(4) Ropes shall be equivalent in strength to at least 1 inch (2.5 cm) diameter first grade manila rope.

(t) *Interior hung scaffolds.*

Bearers (use on edge): 2×10 in.

Maximum intended load: Maximum span 25 lb/ft<sup>2</sup>: 10 ft.

50 lb/ft<sup>2</sup>: 10 ft.

75 lb/ft<sup>2</sup>: 7 ft.

(u) *Needle beam scaffolds.*

Maximum intended load: 25 lb/ft<sup>2</sup>

Beams: 4×6 in.

Maximum platform span: 8 ft.

Maximum beam span: 10 ft.

(1) Ropes shall be attached to the needle beams by a scaffold hitch or an eye splice. The loose end of the rope shall be tied by a bowline knot or by a round turn and a half hitch.

(2) Ropes shall be equivalent in strength to at least 1 inch (2.5 cm) diameter first grade manila rope.

(v) *Multi-level suspension scaffolds.* No additional guidelines or tables are being given for these scaffolds.

(w) *Mobile Scaffolds.* Stability test as described in the ANSI A92 series documents, as appropriate for the type of scaffold, can be used to establish stability for the purpose of § 1926.452(w)(6).

(x) *Repair bracket scaffolds.* No additional guidelines or tables are being given for these scaffolds.

(y) *Stilts.* No specific guidelines or tables are given.

(z) *Tank builder's scaffold.*

(1) The maximum distance between brackets to which scaffolding and guardrail supports are attached shall be no more than 10 feet 6 inches.

(2) Not more than three employees shall occupy a 10 feet 6 inch span of scaffold planking at any time.

(3) A taut wire or synthetic rope supported on the scaffold brackets shall be installed at the scaffold plank level between the innermost edge of the scaffold platform and the curved plate structure of the tank shell to serve as a safety line in lieu of an inner guardrail assembly where the space between the scaffold platform and the tank exceeds 12 inches (30.48 cm). In the event the open space on either side of the rope exceeds 12 inches (30.48 cm), a second wire or synthetic rope appropriately placed, or guardrails in accordance with § 1926.451(e)(4), shall be installed in order to reduce that open space to less than 12 inches (30.48 cm).

(4) Scaffold planks of rough full-dimensioned 2-inch (5.1 cm)×12-inch (30.5 cm) Douglas Fir or Southern Yellow Pine of Select Structural Grade shall be used. Douglas Fir planks shall have a fiber stress of at least 1900 lb/in<sup>2</sup> (130,929 n/cm<sup>2</sup>) and a modulus of elasticity of at least 1,900,000 lb/in<sup>2</sup> (130,929,000 n/cm<sup>2</sup>), while Yellow Pine planks shall have a fiber stress of at least 2500 lb/in<sup>2</sup> (172,275 n/cm<sup>2</sup>) and a modulus of elasticity of at least 2,000,000 lb/in<sup>2</sup> (137,820,000 n/cm<sup>2</sup>).

(5) Guardrails shall be constructed of a taut wire or synthetic rope, and shall be supported by angle irons attached to brackets welded to the steel plates. These guardrails shall comply with § 1926.451(e)(4). Guardrail supports shall be located at no greater than 10 feet 6 inch intervals.

Non-Mandatory Appendix B to Subpart L—Criteria for Determining the Feasibility of Providing Safe Access and Fall Protection for Scaffold Erectors and Dismantlers

[Reserved]

Non-Mandatory Appendix C to Subpart L—List of National Consensus Standards

ANSI/SIA A92.2–1990 *Vehicle-Mounted Elevating and Rotating Aerial Devices*  
ANSI/SIA A92.3–1990 *Manually Propelled Elevating Aerial Platforms*  
ANSI/SIA A92.5–1990 *Boom Supported Elevating Work Platforms*  
ANSI/SIA A92.6–1990 *Self-Propelled Elevating Work Platforms*  
ANSI/SIA A92.7–1990 *Airline Ground Support Vehicle-Mounted Vertical Lift Devices*

ANSI/SIA A92.8–1993 *Vehicle-Mounted Bridge Inspection and Maintenance Devices*

ANSI/SIA A92.9–1993 *Mast-Climbing Work Platforms*

Non-Mandatory Appendix D to Subpart L—List of Training Topics for Scaffold Erectors and Dismantlers

This Appendix D is provided to serve as a guide to assist employers when evaluating the training needs of employees erecting or dismantling supported scaffolds.

The Agency believes that employees erecting or dismantling scaffolds should be trained in the following topics:

- *General Overview of Scaffolding*
  - regulations and standards
  - erection/dismantling planning
  - PPE and proper procedures
  - fall protection
  - materials handling
  - access
  - working platforms
  - foundations
  - guys, ties and braces
- *Tubular Welded Frame Scaffolds*
  - specific regulations and standards
  - components
  - parts inspection
  - erection/dismantling planning
  - guys, ties and braces
  - fall protection
  - general safety
  - access and platforms
  - erection/dismantling procedures
  - rolling scaffold assembly
  - putlogs
- *Tube and Clamp Scaffolds*

- specific regulations and standards
- components
- parts inspection
- erection/dismantling planning
- guys, ties and braces
- fall protection
- general safety
- access and platforms
- erection/dismantling procedures
- buttresses, cantilevers, & bridges

• *System Scaffolds*

- specific regulations and standards
- components
- parts inspection
- erection/dismantling planning
- guys, ties and braces
- fall protection
- general safety
- access and platforms
- erection/dismantling procedures
- buttresses, cantilevers, & bridges

Scaffold erectors and dismantlers should all receive the general overview, and, in addition, specific training for the type of supported scaffold being erected or dismantled.

(Non-mandatory) Appendix E to Subpart L—Drawings and Illustrations

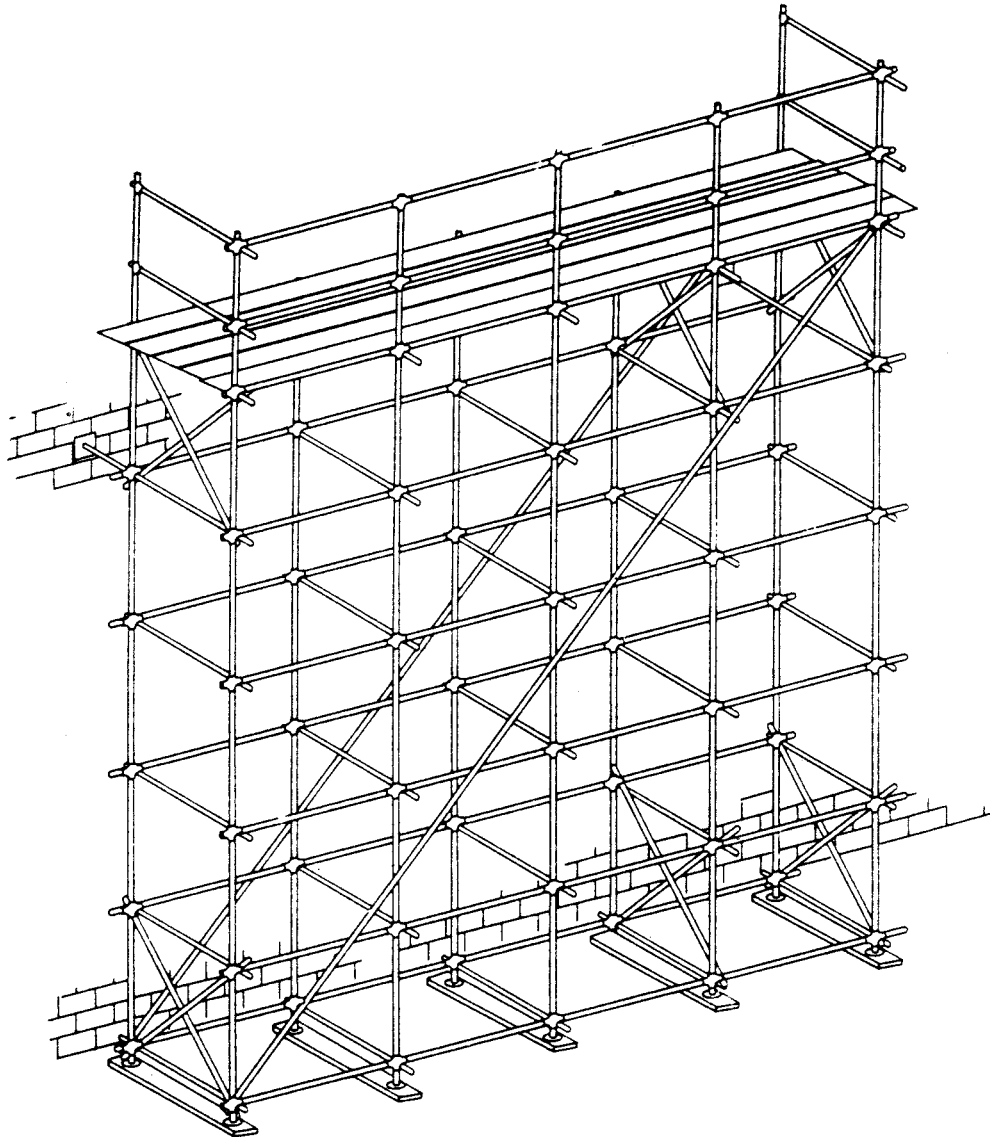
This Appendix provides drawings of particular types of scaffolds and scaffold components, and graphic illustrations of bracing patterns and tie spacing patterns.

This Appendix is intended to provide visual guidance to assist the user in complying with the requirements of subpart L, part 1926.

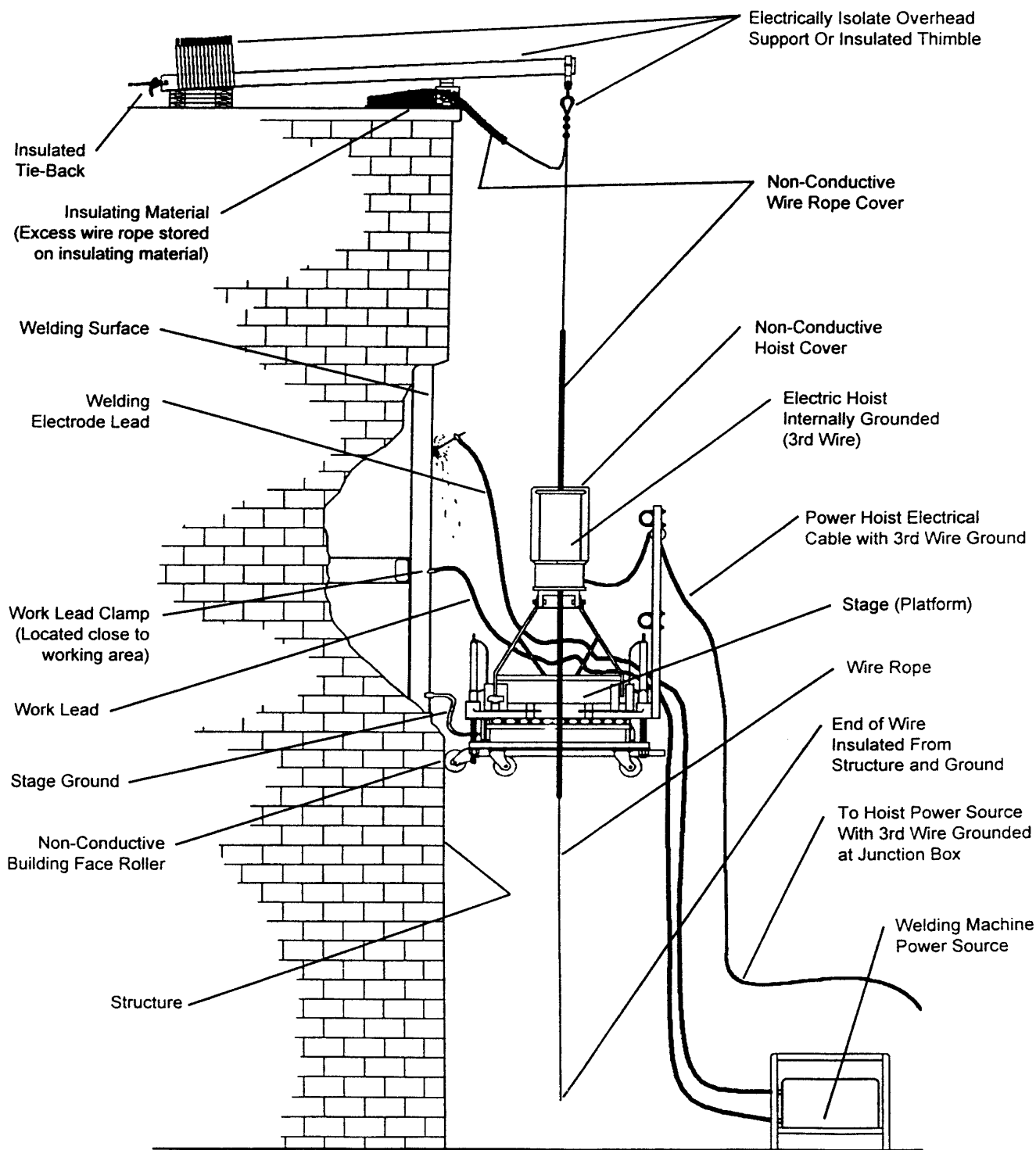
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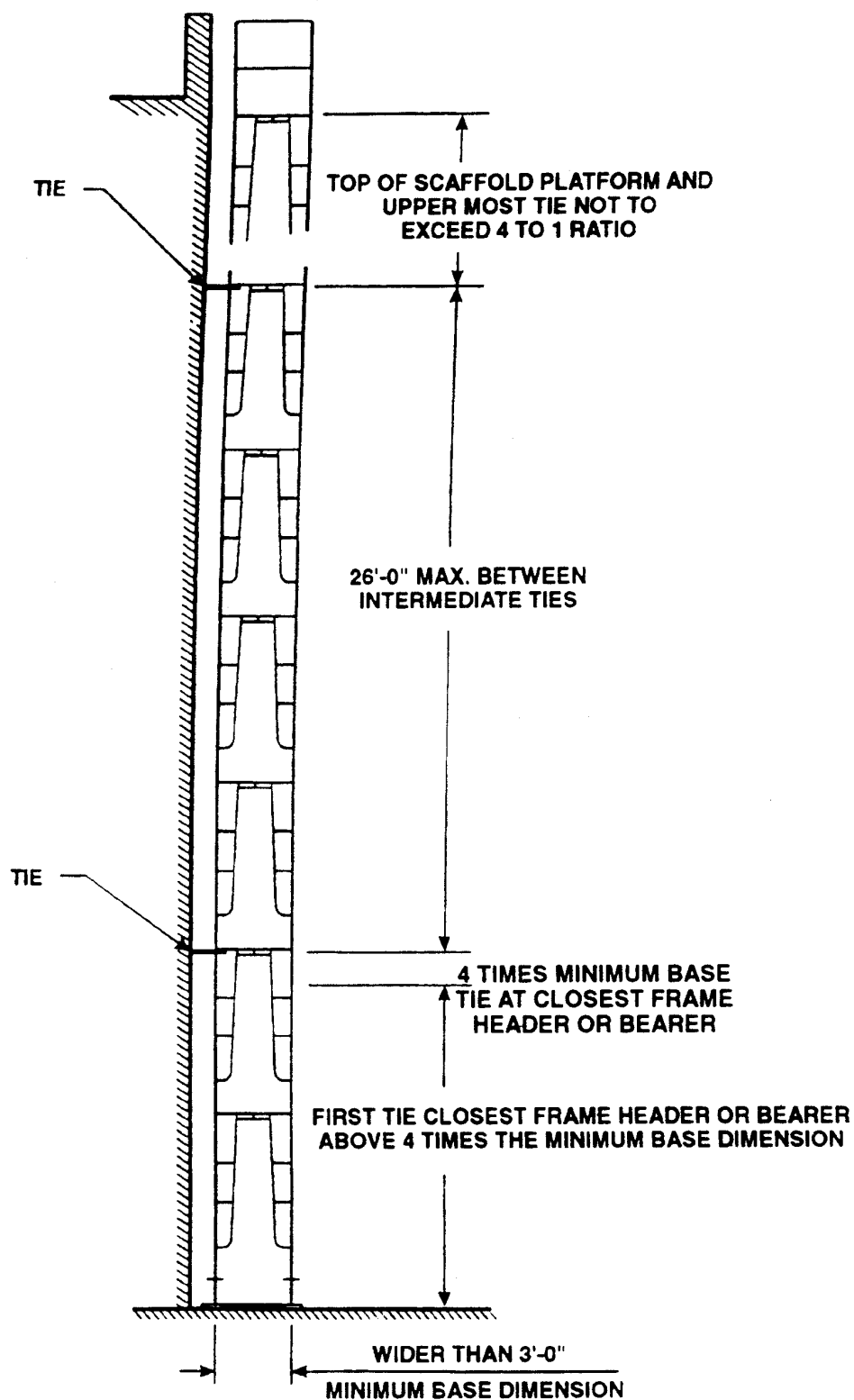
## BRACING – TUBE & COUPLER SCAFFOLDS



## SUSPENDED SCAFFOLD PLATFORM WELDING PRECAUTIONS



## MAXIMUM VERTICAL TIE SPACING WIDER THAN 3'-0" BASES



## MAXIMUM VERTICAL TIE SPACING 3'- 0" AND NARROWER BASES

